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CONTENTS

PAGE

I. CLIMATIC CHANGE AND AGRICULTURAL EXHAUSTION AS ELEMENTS IN THE FALL OF ROME *Ellsworth Huntington* 173

II. THE SEPARATION OF RAILROAD OPERATING EXPENSES BETWEEN FREIGHT AND PASSENGER SERVICES *William J. Cunningham* 209

III. WORK AND PAY: A SUGGESTION FOR REPRESENTATIVE GOVERNMENT IN INDUSTRY *Robert G. Valentine, Ordway Tead* 241

IV. THE GERMAN STEEL SYNDICATE - - *H. R. Tosdal* 259

V. TOTAL UTILITY AND CONSUMERS' SURPLUS UNDER VARYING CONDITIONS OF THE DISTRIBUTION OF INCOME - - - - - - - *Philip G. Wright* 307

REVIEW:

The Carnegie Histories of Commerce and of Manufactures *Arthur H. Cole* 319

NOTES AND MEMORANDA:

Standardization in Marketing - - - *T. N. Carver* 341

Exhaustion of the Soil and the Theory of Rent *F. W. Taussig* 345

Some Considerations on Land Taxation - *J. R. Turner* 348

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CONTENTS FOR AUGUST, 1916

I.	THE FEDERAL RESERVE BANKING SYSTEM IN OPERATION	O. M. W. Sprague
II.	FOX FARMING IN PRINCE EDWARD ISLAND: A CHAPTER IN THE HISTORY OF SPECULATION	A. B. Balcom
III.	THE THEORY OF DIFFERENTIAL RATES	G. P. Watkins
IV.	FIRE INSURANCE RATES: PROBLEMS OF COÖPERATION, CLASSIFICATION, REGULATION	Robert Riegel
V.	CHINESE FINANCE UNDER THE REPUBLIC . . .	A. P. Winston
VI.	GROWTH OF LABOR ORGANIZATION IN THE UNITED STATES, 1897–1914	George E. Barnett
REVIEW:		
	The New Index Numbers of the United States Bureau of Labor Statistics	P. G. Wright
NOTES AND MEMORANDA:		
	Can the Farmer Realize Higher Prices for His Crops by Holding Them?	J. E. Pope
APPENDIX:		
	Membership of American Trade Unions, 1897–1914 . . .	

CONTENTS FOR NOVEMBER, 1916

I.	THE TAXATION OF PROPERTY AND INCOME IN MASSACHUSETTS	Charles J. Bullock
II.	WHY ORGANIZED LABOR OPPOSES SCIENTIFIC MANAGEMENT	R. F. Hoxie
III.	TEACHING THE INTRODUCTORY COURSE IN ECONOMICS	Charles E. Persons
IV.	THE FALL IN GERMAN EXCHANGE	M. J. Bonn
V.	COMMERCIAL CONTRACTS OF THE GENOESE IN THE SYRIAN TRADE OF THE TWELFTH CENTURY . .	Eugene H. Byrne

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THE
QUARTERLY JOURNAL
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FEBRUARY, 1917

CLIMATIC CHANGE AND AGRICULTURAL EXHAUSTION AS ELEMENTS IN THE FALL OF ROME

SUMMARY

I. Decline in Roman agriculture, 173. — Contrasted views, 175. — Liebig and Simkhovitch on exhaustion of soil, 176. — Conrad on climatic change, 177. — II. Four climatic hypotheses: (1) Uniformity, 178. — Geological view, 178. — Historical view, 179. — Ancient famines, 180. — Water works, 181. — Cyrene, 181. — Ilandarin, 182. — Ancient vegetation and crops, 183. — (2) Local changes and deforestation, 185. — (3) Progressive change in one direction, 185. — (4) Pulsatory or irregular changes, 186. — III. Caspian Sea, 186. — California lakes and trees, 188. — Palmyra as an example of effect of climatic changes, 188. — Nature of such changes, 189. — Dates of changes in old world and new, 191. — IV. Historical effects of changes: (1) Economic results, agriculture, forests, cattle, 194. — (2) Political results, taxation, barbarian invasion, 198. — (3) Biological results, elimination of Nordics, increase of malaria, decline of physical energy, 201. — V. Climate and civilization, 204. — Conclusion, 207.

I

In history as in science the normal order is from obvious facts to hidden causes. The fact of the disastrous fall of Rome is so obvious that every intelligent person is aware of it. Its causes are so obscure that the world is still uncertain what they are. Among the many theories advanced in explanation of this great historical

event, one of the most interesting is that of Liebig,[1] which has recently been admirably restated by Professor Simkhovitch.[2] According to the view of these two authors one of the fundamental factors in the fall of Rome was a marked decline in agriculture. We are told that in the days of the Roman Republic seven jugera, or about four and one-half acres of land, sufficed for the tillage required to support an average family. Agriculture was so intensive that farms of this small size, supplemented presumably by pasture land, supported a contented, self-respecting, and progressive population. The cities, all of which were small, reflected the sturdy independence of the country people, and naturally the government was modeled to fit the citizens who administered it. By the second century before Christ, however, a great change was apparent. Under Scipio in 196 B.C. grain began to be distributed from state granaries to poor citizens. Soon came the agrarian troubles with which the names of the Gracchi are associated. Seven jugera were no longer sufficient for the average farmer. Indeed, the farmers in many places were becoming poverty stricken. Instead of sowing their fields with a scientific rotation of carefully tilled crops, they were turning them over to pasturage. Cato declared that good pasturage was the best thing for a farmer, fair pasturage the second best, poor pasturage the third best, and ordinary field crops only the fourth resource. Pessimists declared that in their wheat fields the farmers reaped only four times the seed that they sowed. In later centuries, especially from the second century A.D. onward, conditions became still

[1] Justus von Liebig, Die Chemie in ihrer Anwendung auf Agricultur und Physiologie. 9te auflage, 1876, pp. 51 ff. For this reference and others I am indebted to Professor Taussig.

[2] V. G. Simkhovitch, "Rome's Fall Reconsidered," Political Science Quarterly, June, 1916.

worse. Many farms were utterly abandoned, the land was concentrated in the hands of a comparatively few large proprietors. The tenants fell into chronic debt and were little better than slaves. So eager were many of them to escape from the thraldom in which their poverty kept them that they flocked to the cities, until laws were passed which bound them to the soil as serfs. All these and many other evil consequences appear to have flowed from a widespread decline in agriculture, which, tho alleviated at times, grew worse and worse until Rome finally fell.

The difference between Roman agriculture in early and in later times has given rise to a warm debate. One side is represented by Durneau de la Malle.[1] As he put it: "A vicious system of agriculture, a biennial rotation, the ignorance of the methods of alternation of crops, the too frequent rotation of wheat on the same land, the insufficient and poor preparation of manure, the slight extent of artificial grasslands, the small number of animals supported on cultivated crops, the imperfection of the methods and instruments of culture, the vicious practice of burning the straw in place of converting it into manure — these and a hundred other deadly practices which it would be too long to enumerate form the conflicting but true picture which Greek and Roman agriculture on the whole present to us." Rodbertus[2] strongly contested this view. He attempted to show that the Romans had a most admirable system of agriculture, being familiar with the rotation of crops and the use of fertilizers, and that more labor was expended per acre than is now spent on the best fields of Germany. That there was agricultural decline he

[1] Quoted by Rodbertus in the paper cited below.

[2] Rodbertus, "Zur Geschichte der agrarischen Entwicklung Roms unter den Kaisern," Jahrbücher für Nat. Oek., vol. ii, (1864) pp. 213–19.

admitted, but he ascribed it to social causes. In the writings of such men as Varro, Cato, Pliny, and Columella he accepts the parts which indicate that the science of agriculture was highly developed, but says that other portions must be taken "cum grano salis." He thinks the Latin writers have been misunderstood or that their statements can be explained by other circumstances. For instance, he supposes that when Rome was able to reach out and obtain grain from other lands the Italian farmers turned their attention to vineyards, olive orchards, and cattle raising, and only the worst fields in Italy were devoted to wheat. Hence it was not surprising that the farmers reaped only four times what they had sowed.

Professor Simkhovitch ably shows that these two views are not really contradictory. The picture painted by Rodbertus indicates the condition in the early days, when Rome was in her prime. The other presents the conditions of later times. Simkhovitch ascribes the difference to exhaustion of the soil. Such exhaustion, as he says, is not a necessary consequence of wrong cultivation, but arises only when unwise methods are pursued. As Van Hise[1] points out, the most crucial element in the exhaustion of the soil is the depletion of the phosphorus, which can be prevented only by abundant fertilization.

The idea that such depletion plays an important part in the decline of nations finds frequent expression. Fetter,[2] for example, expresses a not uncommon view when he says that in Asia "the effects of bad husbandry" have caused "lands that once supported millions of people, perhaps tens of millions" to become

[1] C. R. Van Hise, The Conservation of Natural Resources in the United States, 1912, pp. 322 and 338.

[2] F. A. Fetter, Economic Principles, 1915, p. 445.

deserts. He even goes so far as to imply that the decline of Egypt as well as of Rome was due largely to this cause. No one, however, has stated this view more authoritatively than Liebig.

The opponents of Liebig's hypothesis fall into two classes: these who, like Rodbertus, ascribe the fall of Rome to social and political causes, and those who believe that altho it was due to physical causes, exhaustion of the soil was only a minor factor. One of the first to expound this latter view was Conrad.[1] He was ready perhaps to accept Liebig's statement that "the productivity of the soil alone has caused the rise and fall of nations, and, in a word has made history," but not as it was meant. Speaking of Mesopotamia and the accounts given by Herodotus and Pliny of the marvelous grain crops in ancient times compared with the present sterility of the country, he says: "If we put with this fact the observation of Herodotus that the climate of Assyria was too moist for vineyards, one is led to the conclusion that a decrease of precipitation has taken place, that the present water supply and the present aridity did not prevail in antiquity — a conclusion which alone is enough to explain the present desert condition of the country." He also showed that there is similar evidence of a diminution of the water supply in Greece and elsewhere, while he thought that in Italy volcanic disasters and deforestation were great factors in causing historic decay.

In the half century since Conrad challenged Liebig's interpretation, our knowledge of the climate of the past has increased. Today there is a large body of evidence which seems to indicate that climatic changes have occurred during the last two or three thousand years, and that they may have caused many of the results

[1] J. Conrad, Liebig's Ansicht von der Bodenerschöpfung, Jena, 1864.

which Liebig and Simkhovitch have ascribed to exhaustion of the soil. The fact of a ruinous decline of agriculture not only in Italy, but in many other lands, can scarcely be denied. Its consequences were clearly disastrous. If climatic changes may have been responsible for the decline, it is well to discuss the general problem of changes of climate before proceeding to a consideration of Rome specifically.

II

Four chief climatic hypotheses have held the field. Their key words are (1) uniformity, (2) local changes, (3) progressive world-wide change in one direction, and (4) pulsatory or irregular changes sometimes in one direction and sometimes in another.

The evidence as to the climate of the past is primarily geological, even tho we are dealing with historical times. Ruins are to all intents and purposes fossils, while alluvial deposits, river terraces, old lake strands, the amount of salt in enclosed lakes, and the character of extinct vegetation and animals all belong primarily in the field of geology. Hence geologists are the men best fitted to weigh the evidence and to decide as to the climate of the past. The general attitude of the American geologists who have specialized in climatic studies may be judged from the following quotation from a letter written by Dr. W. D. Matthew in response to a series of questions sent out by the author: "As a geologist, accustomed to the concept of a changing earth, which must needs involve climatic changes, I should demand proof before I would admit that there had been *no* change within two thousand years. Such evidence as I know of points to considerable changes at various localities within the past few thousand years."

Altho geologists have abandoned the old idea of climatic uniformity, students in other lines are less completely in accord. Accordingly, let us examine the four hypotheses and see how they appeal to various kinds of students. The hypothesis of climatic uniformity is still held by a small minority of meteorologists. Their strongest argument is that altho the meteorological records of the past one hundred years show a constant recurrence of short cycles, they do not show any progressive change in one direction. Omitting rainfall records, which all admit to be too unreliable for accurate conclusions, they pin their faith to temperature. They forget that according to the best authorities on the glacial period the mean temperature of the earth at that time was possibly only 10° F. lower than at present, and certainly not more than 15° or 20°. As the last glacial period almost certainly culminated at least 20,000 years ago, and perhaps much more, the average change of temperature from that time to this cannot have exceeded a tenth of a degree per century. Early meteorological records are too few and inaccurate to permit us to detect a change of even half a degree in a century. Hence it seems scarcely allowable to use them as an argument in favor of a climatic uniformity, which geologists almost unanimously reject.

Among historians another type of argument is frequently advanced. They admit that the ruins of western Asia and northern Africa, the depopulation of the lands around the Mediterranean Sea, and the decline in agriculture and commerce in that region all look as tho they were the result of climatic changes. But appearances, they say, are deceptive. Misgovernment, pestilence, war, and the inevitable decay of an old civilization are the causes of these signs of decay. The value of this argument may be judged from the words of Professor

Simkhovitch.[1] "The steady shrinkage of population in the ancient world did not follow, curiously enough, in the wake of its bloodiest wars, but in times of complete peace. The fearful losses of Rome's greatest wars on the other hand, losses for instance occasioned by the Punic Wars, were rapidly made up, and in spite of further wars the population was steadily increasing. The same was true of the temporary decrease of population occasioned by a plague, Different was the situation in the period under discussion [that is, the period of the steady decline of Rome]. Losses occasioned by war and plagues were never made up, and during the longest and profoundest peace that Rome ever enjoyed the Roman population was steadily shrinking and its national strength steadily melting away."

One of the most forceful arguments in favor of climatic uniformity is the undeniable fact that in ancient times people suffered severely from aridity. The seven years' famine in Egypt during the days of Joseph is only one among hundreds of cases where ancient historical records prove that great distress arose from temporary failure of the crops for lack of water. To prove that people suffer from drought, however, proves nothing as to the average rainfall. Countries with an average of fifteen inches of rain per year suffer from famine if the rainfall is reduced to ten inches for a few years. In the same country a rainfall of twenty inches per year would cause famine if the average were thirty inches. Such a famine would be worse than the one caused by ten inches, for more people would live in the country when the rainfall was larger, and the suffering would be correspondingly greater. Hence altho the argument from famine proves unmistakably that there was less rain at

[1] V. G. Simkhovitch, "Rome's Fall Reconsidered," Political Science Quarterly, p. 226, June, 1916.

a certain time than at some preceding time, it sheds little light on the relative amount of rain two thousand years ago and now.

Another argument in favor of climatic uniformity is the Roman water works in Syria, North Africa, and elsewhere. Would the Romans ever have gone to such labor if they had not felt the pinch of aridity? Look at the tunnels of Kharga, the reservoirs of Cyrene, and a hundred similar works. Do they not prove that water was so scarce that every drop had to be hoarded? One can only answer that unquestionably water was scarce, but the case is like that of famines. Water may be scarce with a rainfall of ten inches or thirty. It all depends on how many people there are.

Let us examine two specific cases: Cyrene in North Africa, and Ilandarin in Syria. Professor J. W. Gregory has made a careful study of the water supply available at Cyrene both from the springs and the reservoirs. He thinks that in that dry climate the minimum allowance per day for each inhabitant is eight or ten gallons, for this would have to suffice not only for household purposes, but for cattle and flocks, and for the irrigation of gardens. Hence he concludes that Cyrene can never have had more than about 25,000 inhabitants, for he does not admit that the climate may have changed. The ruins, however, are of great size and magnificence, and suggest a population far in excess of 25,000. Dr. D. G. Hogarth, who is one of the best authorities on such matters, states that there is "surprisingly good" authority that Cyrene had at least 100,000 inhabitants.[1] This case is typical of scores. The natural interpretation is that the water supply was once more abundant than now. If it be assumed that there has been no change of climate, we must also assume that the his-

[1] J. W. Gregory, Cyrenaica, Geographical Journal, vol. 47, p. 321, London, 1916.

torical and archeological evidence as to the importance of such places is misleading.

Ilandarin is a striking ruin on the borders of the Syrian Desert fifty miles northeast of Homs. According to Professor H. C. Butler, the nearest water is now two hours away to the west.[1] Yet once Ilandarin was a large city, walled and containing at least ten churches whose ruins are still visible. Like other Roman towns it had its water works. A great reservoir stood at one end of the town, while near the center was a large bath located higher than the reservoir and therefore drawing its water from some other source. The city covered an area about a mile square. Its population, according to Professor Butler, must have been at least 20,000 and may have been 100,000. Its case is like that of Cyrene, only far worse — today water enough for not a single inhabitant, formerly enough for tens of thousands and for a wasteful institution like a Roman bath.

In order to reconcile such facts with the hypothesis of climatic uniformity, it is necessary to suppose that earthquakes may have diverted underground waters, or that there were formerly tunnels of great magnitude which have fallen into ruin and whose location is no longer known. If Ilandarin were the only case of the kind, such reasoning might carry weight. But it is literally only one among thousands scattered from Mongolia to Gibraltar, and from Texas to Arizona and Sonora. If ancient water supplies have been diverted from all these places, there ought to be great numbers of cases where the water is found in some new location not far away. But I know of no case where supporters of the hypothesis of climatic uniformity have even attempted to point out what has become of the water

[1] For a full statement of Professor Butler's views see "Palestine and its Transformation," Boston, 1911, p. 291.

in any specific instance. Moreover, when the old aqueducts are diligently searched out and repaired, as at the oases of Kharga in the Libyan Desert and Palmyra in the Syrian Desert, the water that is forthcoming appears always to be utterly inadequate to the size of the ruins and to the labor spent on the ancient water works. Hence the logical conclusion seems to be that in late Roman times there was not indeed as much water as the inhabitants wanted, but much more than at present.

The chief bulwark of the hypothesis of climatic uniformity is the evidence of vegetation. Again and again we are told the classical writings furnish abundant evidence that in the past the crops of a given country were in general the same as at present. Ignoring such plants as the famous medicinal herb known as sylphion, which once grew abundantly in North Africa, but has now completely disappeared, believers in climatic uniformity dwell on the vine and the palm. These two plants grow in areas which are almost mutually exclusive. Only in a narrow strip will both flourish together. This strip includes Palestine today, and included that country in classical times. A change of 2° or 3° F. in mean temperature would exclude the palm if the temperature were lower and the vine if it were warmer. Therefore, there has been no change of climate. This argument has seemed conclusive to many people, but it ignores two essential points. In the first place, in subtropical regions with winter rains and dry summers the crops are essentially the same whether the rainfall is fifteen inches or thirty. If there is doubt of this, compare the gardens and fields of Damascus with those of the western side of the Lebanon Mountains where the rainfall is at least twice as great. In Greece the rainfall on the west coast is twice as great as in Attica, but irrigated areas

in Attica raise everything that is raised on the west coast. Therefore, the fact that the crops today are essentially the same as those of the past does not show whether the rainfall has increased or diminished. In the second place, the argument as to uniformity on the basis of vegetation ignores the conclusions of geologists. To the layman it may seem scarcely credible that a change of only 10° or 20° F. could shroud eastern North America in ice as far south as the Ohio River; but we must accept the decision of the specialists. If the climate two thousand years ago differed from that of the present one-tenth as much as today's climate differs from that of the glacial period, the fact would be of the utmost significance; yet it would involve a change of mean temperature amounting to less than 2° F. This would not exclude either the vine or the palm from Palestine, and would not be appreciable in such rough records of agriculture as have come down from classical times.

Taken all in all the hypothesis of climatic uniformity does not seem to be well grounded. It is directly opposed to the conclusions of geologists. The arguments in its favor, so far as they are based on temperature, are inconclusive because whatever change of temperature has occurred appears to be very slight. The arguments based on ruins are also inconclusive, because they depend merely upon the assumption that something may have happened to destroy the water supply; they offer no proof as to what has happened. The evidence afforded by famines and ancient waterworks fails like the other evidence in proving climatic uniformity. It proves that in the past some periods have been drier than others, but it does not prove that the average conditions then were the same as now.

If the preceding discussion is sound, we must conclude that climatic changes have taken place during historic

times. The next step is to choose among the three types of change, namely, local changes, a progressive or steady change in one direction, and pulsatory irregular changes. Local climatic changes have often been supposed to be due to human activities, such as the cutting of forests, the opening up of a country to agriculture, the introduction of irrigation. Geographers, geologists, and meteorologists, however, are now practically unanimous in believing that such actions produce only slight climatic effects. In spite of innumerable statements to the contrary, it seems almost certain that northern China, for example, does not owe its unfavorable climate to the cutting down of trees, but owes the absence of trees to the dry climate. The wholesale destruction of forests may work havoc if the ground is swept bare by fires and the soil is washed away, but this does not appreciably change the rainfall. Unwise agriculture or excessive pasturage of sheep and goats may allow the soil to be washed away from the hills, but this again does not appreciably change the rainfall, altho it greatly alters the habits of the rivers and springs.

The hypothesis of a progressive and world-wide climatic change in one direction has also been practically abandoned by geographers.[1] The almost universal

[1] This statement is based partly on the fact that during the past ten years even such defenders of the hypothesis of progressive climatic changes as Kropotkin have modified their views in the direction of irregular or pulsatory changes. (See Geographical Journal, vol. 43, p. 451, London, 1914.) It is also based on the answers to a series of questions recently sent out by the writer to the members of the Association of American Geographers, to a list of geologists selected by Professor Joseph Barrell, to the Climatic Committee of the Ecological Society of America, and to a few meteorologists not included among the geographers. Among those from whom replies have thus far been received only three believe unequivocally in climatic uniformity during historic times. Only one thinks that changes have occurred mainly through human actions, altho a considerable number believe that these have been of subsidiary importance. Three accept the idea of a change which progresses steadily in one direction. The remainder, forty-nine in number, believe that during the past two or three thousand years climatic changes have taken place on a scale greater than during the past century. Practically all of the forty-nine hold that while there have been irregular or pulsatory changes, the general tendency has been toward greater aridity in the Mediterranean countries and other similar regions.

opinion of geologists, as we have seen, is opposed to the idea of any long *steady* change in one direction. Of course, the net result of the 20,000 to 30,000 years since the Glacial Period has been a change in one direction, but this change appears by no means to have taken place regularly. In the same way, during the historic period there appear to have been similar irregularities, altho the general tendency has been toward less favorable rainfall in southern Italy and the other lands around the Mediterranean. Elsewhere, for example on the southern border of the subtropical desert belt, the change may have been in the opposite direction; but that does not now concern us.

III

If pulsatory climatic changes have taken place, they may have been of such widespread historical importance that it is worth while to consider the evidence in regard to them. When the climatic facts of historic times are carefully sifted, certain epochs present evidence indicating a change in one direction, while other epochs indicate the contrary. For example, the somewhat vague accounts of the Caspian Sea before the time of Christ seem to be much more intelligible if the lake stood about 150 feet higher than now, so that it almost coalesced with the Sea of Aral. Strabo, writing about 20 A.D., gives data as to the distance from the mouth of the Phasis River in the Black Sea to that of the Cyrus in the Caspian, as to the size of the sandy plain on the west coast of the Caspian, and as to other features. From his figures, Khanikof estimates that at that time the sea stood about eighty-five feet higher than now.[1]

[1] Humboldt's Asie Centrale is perhaps the greatest source of information on this subject. For a summary of his results see The Pulse of Asia, by the present writer, pp. 327 ff., Boston, 1907.

Six or seven centuries after Christ the lake had fallen to a level fifteen feet or more below that of today, as is proved by the presence of old walls submerged beneath the water on both the east and west coasts. By the tenth century, however, the water had apparently risen at least twenty-nine feet above the present level, and later it rose still higher. The Arab geographer Istakhri, for instance, says that in his day, about 920 A.D., the water rose to the sixth tower of the wall at Derbent; and as that tower can still be identified, we have an exact determination of the lake level.[1] A ruined caravanserai at Baku stands in water fifteen feet deep, and appears to indicate that about the twelfth or thirteenth century the lake again stood at a low level. Still later, in the early fourteenth century, Sheikh Sefi-Eddin tells us that the lake rose to a certain holy grave which now lies thirty-seven feet above the present datum level. This last change of level was possibly due in part to variations in the course of the Oxus River. The drowning of the "Dragon Town" in Chinese Turkestan, however, by the rising of the waters of Lop-Nor, indicates excessive rain at this very time in Central Asia.[2] The occurrence, between 1290 and 1450 A.D., of the five coldest winters on record, if we may judge by the freezing of the Baltic Sea, proves that this was also a time of peculiar climatic severity in northwestern Europe.[3] Moreover, the Dead Sea and certain lakes, such as Gyöljuk in Turkish Armenia and Seistan in Persia, are known to have fluctuated in the same way as the Caspian Sea, and at approximately the same time, so that the climate must have varied from century to century.

[1] See E. Bruckner, Klimaschwankungen seit 1700, Vienna, 1890.

[2] See The Pulse of Asia, pp. 287, 344.

[3] A. Norlend, Einige Bermerkungen über das Klima der historischen Zeit. Lunds Univ. Arsskrift, N. F. Abd. 1, Bd. 10; No. 7, 1914.

In America similar climatic fluctuations appear to have occurred during the same period. For example, geologists and engineers calculate that the amount of salt in the water of Searles Lake in southeastern California gives almost certain evidence that the lake must have overflowed and been fresh only two thousand or three thousand years ago. This it could only do by standing about 180 feet above the present level and expanding to two and a half times the present size. Old beaches and other deposits prove that during the two or three thousand years since the lake overflowed the level has in general fallen, but has fluctuated, sometimes falling rapidly, and again rising. The dates of these fluctuations can be determined from the growth of the giant sequoia trees fifty miles away on the other side of the Sierras. In a climate such as that of southern California having a long dry summer, the thickness of the woody rings furnishes an approximate record of the rainfall. This record, as read from 450 sequoia stumps, agrees in general with the pulsations of climate inferred in Asia. Thus in the parts of both the Old and the New World having the Mediterranean type of climate there is evidence of the same kind of irregular changes.

A single concrete example will illustrate some of the ways in which such changes may have influenced the drier regions of the Roman Empire. About the time of Christ the oasis of Palmyra in the Syrian Desert was famous for the sweetness, purity, and abundance of its waters. Today no one in his right mind would praise it for any of these qualities. The brackish water smells strongly of sulphur, and the natives are always disturbed by its scarcity. The gardens, tho pleasant in themselves, seem sadly forlorn and insignificant in their setting of vast ruins. In its prime Palmyra covered at

least as much ground as modern Damascus, and probably had 150,000 inhabitants. Today it has only 1500 at the most. The city reached its greatest prosperity in the third century of our era, when the water supply was apparently diminishing rapidly. This is what might be expected according to the climatic hypothesis. Written records and ruins show that important roads once crossed the Syrian Desert from Petra in the south and from the western Bosra in the latitude of the Sea of Galilee. These roads are today impractical for caravans because of the absence of water and grass. They appear to have been finally abandoned in the second century because of increasing aridity. This naturally threw all the trade between Egypt, Syria, and Damascus on the one hand, and Mesopotamia and Persia on the other, to the route through Palmyra, and thus greatly stimulated that city. By the seventh century, however, when the Mediterranean lands and western Asia apparently became more arid than at any other known period, Palmyra was practically abandoned. In the tenth century, when the water supply for a while became more abundant, it enjoyed a partial recovery, only to decay once more during the next dry epoch. Today the water supply varies directly in harmony with the rainfall of the past few years, and the size of the village changes correspondingly.

Before applying our climatic hypothesis to the fall of Rome, let us gain a clearer idea of the precise changes that have probably taken place in Italy. It does not seem that at any time within the last three thousand years the country had a climate like that of either central Europe or northern Africa. At all times the general character of the seasons has presumably been the same as now. There have been abundant rains in winter and a diminished rainfall in summer. The temperature, as

already pointed out, has apparently not been essentially different from what it is today. The change appears to have been primarily in storminess. As nearly as can yet be determined, tho the winters two thousand to three thousand years ago were not essentially different from those of today, the storms may have been more numerous and more severe. On an average the winds were probably stronger than at present. Therefore, the warm wave which precedes a winter storm was warmer than now, and the cold wave which follows was correspondingly colder. Such conditions would have little effect except upon the sturdiness of the people; but this, as we shall see, may be of far-reaching import.

In the autumn, and especially the spring, the difference between the past and present was apparently greater than in the winter. In the autumn the stormy period probably began somewhat earlier than at present, while in the spring it lasted later. Judging by present conditions in years which go to one extreme or the other, the greatest difference was in the spring. At that time not only were the storms apparently more severe than they are today, but they continued so much later in the season that the total spring rainfall, which is the most essential for agriculture, increased in a greater ratio than did the rainfall at other seasons. Finally, the summers two or three thousand years ago apparently had about the same average temperature as today. Then as now they were decidedly less stormy than the spring. Nevertheless, in summer, as well as at other seasons, the storms of that time seem to have exceeded those of the present both in number and in severity. Hence while the summers were warm, sunny, and comparatively dry, they seem to have had more rainfall than now and to have been more subject to the pleasant changes which mitigate the effects of long steady heat.

There has been so much misconception about this matter that it is necessary to emphasize it. Even if there have been important changes of climate, the succession of seasons in the past was in general like that of today. The chief difference lay (1) in somewhat more abundant rainfall at all seasons and a decidedly greater abundance in the spring, and (2) in greater variability, which would be of chief importance in warm weather. This variability apparently caused the past climate to have more than now of the stimulating quality which today differentiates such a climate as that of Germany, England, or the northeastern United States from that of such countries as Greece or Spain. In general the climate of Italy, from Rome southward — the part of the country with which we are mainly concerned in classical times — resembled that which now prevails in the northern part of the country, but was probably even better at certain periods.

In order to assign to climatic changes their due importance in history it is necessary to understand not only the nature of the changes, but their periodicity. This can best be done by means of diagrams such as I have published in my book *Civilization and Climate*. Figure 33 in that volume (p. 228) shows the variations in the rainfall of western and central Asia as inferred from ruins, lakes, famines, old roads, and other evidence available previous to 1910. The solid line shows changes of climate in California on the basis of the growth of the Big Trees measured in 1911 and 1912. Later studies indicate that the dotted line should be modified as indicated by the dashes and also in certain other respects — for example, about 400 B.C., where it should rise higher. The original curve, however, is reproduced in order to show the resemblance between the conclusions reached in two continents by wholly

diverse methods. In general, the two lines of Figure 33 indicate that approximately the same changes have taken place in similar climates in the two hemispheres. It would not be justifiable, however, to assume complete similarity in all the details. Moreover, according to conclusions reached simultaneously and independently by Penck in Europe and by the writer in America, climatic changes seem to consist of a shifting of the various zones first toward the equator and then away from it. Accordingly, a change may occur in one place somewhat later than in another.

Altho the results presented in *Civilization and Climate* are by no means final it seems allowable to use them as the basis of a study of the fall of Rome. While not applying directly to Italy, the curve of the Big Trees seems to show the main trend of events in that country as well as in California.[1] Omit-

[1] It may seem at first sight that Italy and California are so far apart that the record of the Big Trees cannot safely be applied to the problem of this paper. Such, however, is not the case, as appears from three lines of evidence: (1) The growth of the trees is the only means thus far available for actually measuring the effect of climate year by year throughout the historic period. Therefore until further data are available it is our best yardstick. Recent studies of the relationship between present variation of atmospheric pressure or temperature in widely separated parts of the earth make it practically certain that a change in California must be accompanied by a change in the Mediterranean region. The question is whether the changes in the two regions are of the same kind. (2) A comparison of the two curves of Figure 33 in Civilization and Climate shows that in general similar variations have taken place in California and western Asia. The agreement of the two curves is particularly noticeable from 800 A.D. to the present time, that is, during the period when the data are most abundant. Moreover, since the Asiatic curve was prepared, in 1910, a good deal of new evidence has become available. It all indicates an agreement between the Asiatic and California climates. For example, the explorations of Stein in Central Asia indicate that the second century B.C. was drier than appears in the dotted line of Figure 33. The statements of Herodotus, on the other hand, seem uniformly to point to abundant moisture in the second half of the fifth century B.C., thus harmonizing with the tree curve. (3) The third and strongest reason for thinking that tree growth in California may be used as a measure of the rainfall of southern Italy is the fact that at the present time the two phenomena vary in harmony. Let us confine our attention to the months from March to July, since they are critical for agriculture in both California and the Mediterranean countries. The two longest rainfall records in California, those of San Francisco and San Diego, give an idea of the main climatic fluctuations in southern California since 1851. Figures are available for a comparison of these fluctuations with the annual growth of 112 sequoia trees in the Sierra Nevada Mountains, and with the rainfall at Rome, Naples, and Jerusalem for the fifty-five years from 1851 to 1905.

ting the earlier and more doubtful centuries, it appears that from 450 to 250 B.C., Italy probably enjoyed a highly favorable climate. During the next fifty years there was marked deterioration. Throughout the second century, conditions were less favorable than before, altho on the whole they were improving. Even

The method of comparison is to arrange the years of each record in order according to the amount of rain in California. The years are then divided into the four groups indicated below, and the averages are obtained. In computing the tree growth the averages for the three years beginning with a certain condition of rainfall have been used in one case, and the third year after a given rainfall in the other. This is because the growth of the sequoias depends more upon the rainfall of preceding years than upon that of the year in question.

Groups of Years

I. 7 years with heaviest rainfall in California, i. e., an average of over 6.5 inches.
II. 18 years with heavy rainfall in California, i. e., 3.9 to 6.4 inches.
III. 17 years with light rainfall in California, i. e., 2.7 to 3.8 inches.
IV. 13 years with least rainfall in California, i. e., less than 2.7 inches.

The average rainfall (columns A to D) and the average growth (columns E and F) for the four groups are as follows:

	Average Rainfall				*Average Growth of Trees*	
	A	B	C	D	E	F
	San Francisco and San Diego	Rome	Naples	Jerusalem	3 years	Third year
I.	8.3 in.	10.7 in.	11.5 in.	7.0 in.	3.02 mm.	3.07 mm.
II.	4.5 "	10.6 "	11.0 "	6.3 "	3.00 "	3.04 "
III.	3.4 "	9.8 "	9.2 "	5.6 "	2.98 "	2.99 "
IV.	1.9 "	9.6 "	8.6 "	5.2 "	2.92 "	2.84 "

Without exception all the columns from B to F vary in harmony with the California rainfall, A. At Rome the agreement with California is less marked than at Naples, while at Naples, when reckoned in percentages, it is less noticeable than at Jerusalem. At Palermo, however, the agreement is probably at least as marked as at Jerusalem, as appears from the following table for the twenty-six years for which rainfall records are available at the time of writing.

(1)	10 years with average rainfall of 5.8 in California		Average 8.3 at Palermo.
(2)	8 " " " " " 3.6 " "	"	7.6 " "
(3)	8 " " " " " 2.4 " "	"	6.2 " "

The Indian Meteorological Service has shown that in winter and spring storms of a certain type pass from the western Mediterranean across Syria, Mesopotamia and Persia to northern India. This type of storm appears to increase when the rainfall is abundant in California and the sequoia trees grow rapidly. This does not mean that a single year of heavy rainfall in California is sure to be accompanied by abundant rain in Italy and the other Mediterranean lands. It does mean, however, that at present when any considerable group of years is considered, the growth of the sequoias indicates the general conditions of rainfall in those countries. Presumably the same was true in the past. So far as can be judged from the growth of the sequoias and from the other data now before us, it appears as if the rainfall of southern Italy during the months from March to July at the time of Christ may have been from 50 to 100 per cent greater than at present.

at the worst, however, they were distinctly better than today. From 100 B.C. to 50 A.D. more favorable conditions ensued, altho not equal to those during the pristine days of the Roman Republic. Next came a sudden deterioration so that the second century of our era was unfavorable, altho possibly not so much so as the second century before Christ. After a slight recovery at the end of the second century and the beginning of the third, there began a long and steady decline in climate until the final fall of the Western Empire. The next century and a half saw a slight improvement until the beginning of the seventh century. Then followed the two worst centuries of the historic period, altho possibly the thirteenth century B.C. may have been almost as bad.

Turning now from the physical side of our problem, let us consider the probable historic results of the adverse climatic changes that appear to have taken place between 250 B.C. and 650 A.D. It will be understood that the reverse of what is here described is supposed to characterize favorable changes.

IV

We may divide the results of climatic changes into three groups: economical, political, and biological. For a statement of the economic conditions I cannot do better than refer to Professor Simkhovitch's article already quoted. I do not agree with him in thinking that exhaustion of the soil was the primary cause of the conditions which he describes, for in countries like Syria cultivation by the methods which he deplores has continued for thousands of years, and people are still fairly prosperous wherever water is abundant. Nevertheless, his description of the decline of agriculture is

most weighty. In showing "how the great agricultural scholars of the time analyzed the situation," he quotes the following extracts from Columella, who wrote about 60 A.D.: "I frequently hear the most illustrious men of our country complaining that the sterility of our soil and intemperate weather have now for many ages past been diminishing the productivity of the land. Others give a rational background to their complaints, claiming that the land became tired and exhausted from its productivity in the former ages, and hence the soil is no longer able to furnish sustenance to mortals with its former liberality." [1]

This quotation sets forth two theories as to the cause of the agricultural decline of Rome. In Columella's day the most illustrious men of Rome apparently complained that a change of climate had for ages been producing sterility and thus diminishing the crops. Others, whom Columella thinks more rational, believed that the soil of Rome had become exhausted. Nevertheless, as Columella himself points out, the Romans in the former ages were familiar with the most effective methods of cultivation. As Simkhovitch puts it, "the intensive farming of the Romans on seven-jugera farms, was like the farming of the Chinese and Japanese, very intensive, their small grain fields being planted in rows, hoed, and weeded and carefully manured with excrements and ashes and stable dung. The experience of China and Japan has shown that on very small land plots such intensive agriculture can maintain itself indefinitely without any recourse to scientific repletion of the soil by mineral fertilizers."

In view of this we must apparently assume either a most profound and astonishing change in Roman

[1] This passage had already been quoted by Liebig, Die Chemie in ihrer Anwendung auf Agrikultur. . . . 9th ed., p. 53.

character, or else a change of climate. If the Romans knew how to farm like the Chinese and Japanese and thus indefinitely to ward off the effects of the exhaustion of the soil, but failed to do it when they found themselves falling into dire distress, they surely had suffered an "inner decay" that is scarcely conceivable. On the other hand, if they had not rain enough in the late spring, no amount of care and cultivation would make it possible to carry on intensive agriculture.

One of the most notable features of the curve of tree growth in California was the decline from about 250–200 B.C. If a similar change occurred in the rainfall of Italy it would tend to kill the forests or at least to reduce their density and render them an easy prey to fires and to the depredations of sheep and goats. Hence the soil would be left unprotected, and the rains of winter would wash it down to the lowlands and thus spoil many a good farm in the way that Simkhovitch well describes. In their place great swamps would be formed. Few people realize that some of the greatest swamps are located in the driest countries. In Transcaspia I have waited two weeks to cross the flooded tract at the lower end of the Tejen river; in Persia my camels were nearly drowned in crossing a swamp; and in Chinese Turkestan I was nearly engulfed in a grave of mud when the camel that I rode and two others broke through the apparently solid earth into a stinking morass.

In the later days of Rome, *pari passu* with the deterioration of the climate, agriculture progressively declined. Thus by 395 A.D. "the abandoned fields of Campania alone amounted to something over 528,000 jugera." Doubtless much of the land thus abandoned was capable of being restored, for even then the climate was apparently better than at present. That it was not

restored seems merely to mean that when people are waging a losing fight against nature they become discouraged. The change is what counts. A carpenter with an income of $1200 a year feels prosperous, whereas a banker who has had $50,000 a year would feel himself in dire proverty if his income were reduced to $5000. The banker can in time accommodate himself to a diminished income; but suppose that a few years later his income falls to $4000, then to $3000, and finally to only $1500. He may still have more than the carpenter, but he would have to take his children out of college, sell his automobile and house, give up keeping servants, and so utterly change his mode of life that he would feel his condition to be most pitiable.

So it is with countries. In the fourth century B.C., Italy appears to have been favored with so fine a climate that less than five acres was enough to support an average family. Cultivation was highly intensive so that the most advanced methods of agriculture were developed. Failures of the crops were rare, and general prosperity prevailed. The farmers lived in comfort on their little farms and asked nothing of anyone, and the towns reflected their condition. Then when the spring and summer rains diminished — to speak by hypothesis — a small tract of land was not enough to furnish a living for the farmer and his family. Crops that had previously been profitable ceased to be worth while, the farmers ran into debt, and their lands gradually fell into the hands of large landowners. Since crops were no longer profitable the land was used for grazing purposes, as classical writers often point out. This was bad in two respects. In the first place, sheep and goats eat not only grass, but seedling trees, and thus prevent the growth of new forests. Where they pasture in abundance the soil is badly trampled, and is no longer held in

place by roots. Hence it is washed away by the winter rain, leaving the hillsides barren and ruining the fields in the lowlands. In the second place, sheep-raising and cattle-raising demand large areas. Hence they increase the tendency toward the concentration of land in the hands of a few individuals. During the Augustan Age the farmers apparently recovered somewhat, and presumably were better off than in the second century B.C. Then came renewed climatic stress at the end of the first century A.D., and later the long deadening decline that culminated in the seventh century. In those days the Roman farmer was in circumstances as discouraging as those of the banker with a mechanic's income.

Such economic changes must inevitably produce political results. One of the first and most obvious is a disturbance of the system of taxation. Theoretically, taxes ought to be proportioned to the income of the people who pay them. Practically the adjustment is most imperfect, and has a disagreeable way of remaining fixed when other conditions change. When crops are bad the expenses of the government do not diminish. A tax which was easily paid from a full grain bin becomes oppressive when the grain bin is half empty. It is not surprising that the people were discontented and agrarian reforms were needed in the days of the Gracchi. At that time Rome apparently suffered from climatic conditions more unfavorable than at any other period previous to about 300 A.D. Under such circumstances the poverty and discouragement of the many almost inevitably favor the concentration of power in the hands of a few. Hence democracy suffers, and a plutocratic form of government is superimposed upon the old framework. It would be useless to illustrate the matter here, for I should merely be repeating the arguments of Professor Simkhovitch—the only dif-

ference between his view and mine being in the interpretation of the cause of the agricultural decline. Not only Rome itself, but the provinces were suffering, and it is not strange that their discontent was finally an important element in the break-up of the Rome Empire.

The theory that agriculture declined because of exhaustion of the soil seems to have little bearing on barbarian invasions. In this respect it is diametrically opposed to the theory of a decline due to climatic changes. Nomads such as those of central Asia are the first to feel the effect of increased aridity. The springs that they have been wont to frequent on the edge of the desert dry up, grass for pasturage is scanty, and therefore they begin to seek new pastures. At first they may meet with no special difficulty, provided the country is not too densely populated. Soon, however, they come into conflict with neighbors who also press into the well-watered regions where there is abundant grass. When tribe meets tribe and there is not enough grass for all, conflict is bound to ensue. Then the tribe which is obliged to content itself with the less favorable locations is practically certain to take to plundering. It may plunder its nomad neighbors, or it may make raids on the settled villages in the oases or in the better-watered tracts on the desert border.

Any one who has lived in the deserts of Asia knows how this happens. In Palestine and the Syrian Desert, for example, the year 1909 was characterized by an unusually dry spring. What happened? The nomads pushed their way in among the settled population of the cultivated land. Dr. Patterson, a missionary physician at Hebron, says that in his hospital he operated upon gun-shot cases that year to an extent unprecedented in his sixteen years in the country. Within two months I myself had four experiences with raiders. First a party

of Arabs who had already robbed some natives approached my own camp by night, but made no attack because we were on the watch; next I was sleeping in a native camp when some men of another tribe drove off all the camels; a third day we saw a band of raiders on the hills above us, and a man who had been with our party but had fallen behind only escaped by flight. Finally, a member of my escort, who had gone ahead to investigate the road, exchanged shots with a party of raiders and hid for hours before he dared rejoin us. In a good year, on the other hand, one can travel through the same country in perfect security.

If such things can happen because of the drought of a single year, what must have been the effect when aridity became more and more pronounced for centuries? Thousands of people must have been driven from their homes. Such movements begin in the driest regions, such as the great deserts of Transcaspia or Arabia. Where the nomads were met by a solid bulwark like that of the Roman Empire in Syria and North Africa, they could not achieve much; but in eastern Europe, where there was nothing to hold them back, one can scarcely doubt that they must have pressed forward. Thus one tribe would upset another, and a whole continent may have been put in commotion. This, I believe, explains to a large degree the barbarian invasions of Europe during the early centuries of the Christian era. Men do not take their wives and children and move in great masses except under some strong compulsion. I do not need to go into details on the barbarian invasions of Rome. It is enough to point out that they were numerous as long as the climate of Asia grew worse. They spread into each of the southern peninsulas of Europe. They spilled over into Africa. Finally, in the seventh century there came the cul-

minating migration from the desert. The power of the Roman Empire had vanished, and the Arabs surged out under Mohammed. The religious impulse doubtless was of the greatest importance as a unifying factor, but hunger may have been the chief impelling force. So too, in later days, Genghis Khan may have been the unifying factor, but hunger due to a second great period of aridity was perhaps the underlying force that impelled his hordes to surge out of Central Asia.

The biological effect of changes of climate are as yet not well understood. In the end, however, they may possibly prove to be even more important than the political and economic effects. It has long been known that many of the leaders both in ancient Rome and Greece belonged to the fair Nordic race. Why else do so many of the ancient painted statutes of the gods and goddesses of Greece have red or yellow hair and blue eyes? Not all the leaders, to be sure, were tall, fair Nordics; for Socrates, the greatest mind of all, was short and dark — a typical member of the Mediterranean race. Yet the fair people from the north were sufficiently aggressive and dominant to cause the favorite divinities, Zeus, Apollo, Pallas, Diana, and others to be represented as of that race. The climate of both Greece and Italy, however, is thought by many authorities to be too sunny for the blond Nordics. It often induces diseases of the skin and nerves, and in the long run apparently lessens the rate of reproduction. Thus in a climate like that of Italy, especially southern Italy, the agressive Nordic part of the population tends to diminish. This tendency would be less, however, under the conditions which we suppose to have prevailed three or four hundred years before Christ, and on the other hand, would increase with the changes of climate here described. When combined with the Roman prac-

tice of bringing in slaves from conquered countries, it may have helped to bring about a gradual change in racial type. The race which apparently provided the majority of Rome's early leaders appears to have declined in numbers, and the decline was presumably hastened by unfavorable climatic changes.

Another important factor in the biological decline of the people of Rome was perhaps malaria. Ross, Jones,[1] and others have shown that altho malaria was well known in early Rome, it did not become widespread until the second century B.C. About that time it increased greatly and finally became endemic. Any one who has been in a country where this disease is common knows what a scourge it is. At the end of a long dry summer thousands of the population succumb. They seem inert and stupid, unable to think and unable to work. Not merely are they temporarily incapacitated, but they suffer year after year, and are permanently weakened. Ross found that nearly half of the Greeks today bear marks of the disease. Its effects are mental as well as physical. The power of self-control is weakened, and so too is the power of steady thought and of assiduous application to duty. Today with quinine as a universal remedy, and with our knowledge of how to exterminate mosquitoes, malaria is losing some of its terrors; yet it remains a scourge of terrible proportions not only in Greece, but in parts of Italy and in many Oriental countries. In the old days it must have been far worse.

It may perhaps seem a far cry from changes of climate to malaria, but the two are intimately associated. Malarial mosquitoes are found from central Europe to the equator. In Italy the degree to which they

[1] Jones, W. H. S., Malaria: A Neglected Factor in the History of Greece and Rome, 1907.

flourish depends largely on the prevalence of stagnant water. Where rains are abundant at all seasons, stagnant water is rare. Swamps may of course exist, but even there the water is apt to be changed by the rains, and the larvae of the mosquito are washed away and drowned. In the streams they cannot live because of the moving water. For this reason an abundant rainfall prevents the spread of malaria except where the forests remain constantly damp. Such conditions prevail in many equatorial regions, and are one reason why malaria is there such a terrible scourge.

During the period of favorable climate which apparently prevailed in Italy three or four hundred years before Christ, the mountains were probably well wooded, and springs abundant. The streams must have been for the most part perennial, and were presumably well adjusted to their valleys so that they flowed in clearly defined channels. Increasing aridity, as we have already seen, would cause the mountains to become more barren. Consequently the streams would become heavily loaded with mud and gravel. This would be an important element not only in ruining the farms, but in increasing malaria. As physiographers well know, when streams that are heavily loaded with silt emerge from the mountains and enter the plains, they deposit part of their load. Thus they fill their channels, divert themselves into new courses, and gradually spread out into many branches which wander here and there over wide areas, and often produce swamps. When such streams dwindle during the dry summer, most of the channels are converted into mere strings of stagnant pools, ideal places for mosquitoes. Moreover, the drier the summers, the greater the need of irrigation, and this also causes stagnant pools. Thus the supposed climatic changes in Italy were mainly of a kind to in-

duce a great increase in the area where the mosquito was able to thrive. Hence the ravages of malaria were presumably increased, and played a part in destroying the self-control and energy of the Romans.

V

I have left till last what I believe to be the most important effect of climatic changes. Students of the science of ecology, that is, of the adaptation of organisms to their environment, are reaching some surprising conclusions in regard to man. It has been our boast that the human race, alone among animals, is able to dwell in all parts of the world and to adapt itself to all conditions. In proof we point to the fact that white men can live and work in Arctic regions or in tropical Africa. We also point to the fact that the human race has differentiated itself into black people, yellow people, white people, and red people, and that each of these appears to be adapted to a particular kind of climatic environment. It appears now, however, that there are two kinds of adaptation: one to sunlight and the other to temperature and humidity. The adaptation to light can apparently be made with comparative ease. It is a matter of everyday observation that in winter or when people stay in the house at any season the skin becomes pale, whereas exposure to the sun soon changes the complexion of people of fair races. In the same way a change of habitat is apparently followed by a gradual elimination of the people whose complexions are not adapted to the new environment. The adjustment to temperature and humidity appears to be much more conservative than the adjustment to light. A study of the relation of the death rate to temperature among many races and in many parts of the world illustrates

the matter. Taking the year as a whole the number of deaths in all parts of the world varies in close harmony with the temperature. At low temperatures large numbers of people die, which means of course that they are physically weak. Under ordinary circumstances the number of deaths declines up to an average temperature of between 60° and 65° for day and night together. At average temperatures above 65° the death-rate begins to increase, and above 70°, which means when the thermometer rises to approximately 80° or more at noon, it increases with great rapidity, especially if the air is humid. Strange as it may seem, the negro or Cuban in the southern part of the United States shows scarcely more adaptation to a hot climate than does the white man, while the Finn and Swede of the far north are weakened by low temperature almost as much as is the negro. The Japanese death-rate shows that that race also thrives under practically the same conditions as do the whites and negroes.

Other tests also indicate that a mean temperature of from 60° to 70° according to the degree of humidity is physically best for various races; for mental activity one somewhat lower is best. Confining ourselves now to the physical, we find, for example, that factory operatives of European races in the United States work most rapidly, which means that they are strongest, when the temperature averages about 60°. For Cubans in Florida the figure is slightly higher, about 65°, but the difference is not enough to be significant. Tests of the strength of negroes in Virginia give 61° as the best average temperature, while their death-rate is least at an average of about 67°. Experiments on the amount of carbon dioxide in the breath at Manchester, England, indicate 62° as the best temperature. As the tempera-

ture of the blood is the same in all races, so it appears that almost the same outside temperature is probably best for all men, whether black, white, red, or yellow. The same appears to be true of atmospheric humidity, which has a marked effect upon man's capacity for work. A large body of evidence also indicates that changes of temperature from one day to the next as well as from season to season are highly important. In fact no matter how good a climate may be in other respects, it is open to question whether people's energy, strength of purpose, and power of achievement can remain at a high level for generation after generation except in a climate where there is the stimulus of constant change.

On the basis of the actual achievements of thousands of people under different conditions of climate, it is possible to make a map showing the amount of energy which different races would have in different parts of the world on the basis of climate alone.[1] This map is strikingly like a map of civilization. The resemblance of the two indicates that today the active and progressive races, those that dominate the world, are all located in climates which possess a highly stimulating quality. If we are right in thinking that the response to climate is almost the same among all races, the matter is highly significant in our interpretation of the fall of Rome. As we have already seen, the climatic changes which have apparently taken place in Italy appear to have been characterized by a decline in the variability of the weather from day to day, especially in the spring and summer. This means that three or four centuries B.C., Rome was blessed with a climate whose mean temperature was as good as that of today,

[1] Such a map is published in my Civilization and Climate, p. 200. The volume contains a full discussion of the relation of climate to civilization. Since it was published new facts have been discovered which show that the response of different races to climate is more uniform than was supposed when the book was written.

and which at the same time was better than that of the present, not only for agriculture, but in its stimulating effect on human activity. It apparently possessed the sparkle and tang which our own climate in the northern United States possesses to so marked a degree. If this is so, the change which took place between 300 and 200 B.C. and still more the gradual change between the time of Christ and the seventh century probably had an appreciable effect upon the energy and ability of the Roman people. Even if there had been no change in the racial composition of the inhabitants, no malaria, no agricultural distress, and no invasions of barbarians, there still would apparently have been a decline in ability. Such a decline would work particular harm at times when other conditions were becoming adverse. For instance, when irrigation was needed to overcome the difficulties of aridity, it would be particularly necessary that people should have abundant energy and initiative. These qualities would be equally needed to overcome malaria, and to prevent the streams from flooding the fields and creating swamps. Energy too would be especially valuable when the barbarians were threatening invasion, or when political questions were becoming difficult because of agricultural adversity, poverty, burdensome taxes, and consequent general discontent.

The view presented in this paper will seem to many readers to rest on foundations too slender. Even to my own mind the investigation of the relation of climate to human efficiency has brought results so surprising that I find it difficult to remodel my preconceived conceptions. Whether the hypothesis here advanced is right or wrong, it at least has a sufficient foundation to warrant further study. It does not explain why men of genius arise, why political and social institutions evolve,

or why a large part of the events of history occur. It does, however, offer a possible explanation of some of the most puzzling phases of the decline and fall of nations. The test of its accuracy lies along three lines. (1) Geographers must work out far more accurately than has yet been done the exact sequence of changes of climate, their degree of severity, and their nature. (2) Ecologists and physiologists must determine how much of human energy depends on inherited capacity and training, and how much upon physical environment, and especially upon conditions of temperature, humidity, and other climatic elements such as the amount of ozone or electricity in the air. (3) There is a vast field for economists and historians. The geographer may point out the results which he expects at certain epochs because of the climatic conditions. It rests with the historian and economist to determine whether the expected results have actually occurred. It also rests with them to scan the pages of history for the almost innumerable facts which bear on this problem. Gradually the world is seeing how intimately physical, mental, and moral traits are related, and how each reacts upon the other. The lessons of history cannot rightly be understood until the combined work of men in many lines gives us a clear idea of each one of the complex factors leading to such great events as the fall of Rome.

ELLSWORTH HUNTINGTON.

THE SEPARATION OF RAILROAD OPERATING EXPENSES BETWEEN FREIGHT AND PASSENGER SERVICES

SUMMARY

I. Importance attached by Interstate Commerce Commission to cost of service, 209. — II. Its early requirements as to separation of expenses, 212. — Summary of present (1915) requirements of the Commission, 213. — Maintenance of way, 214. — Maintenance of equipment, 215. — Traffic, 217. — Transportation, 217. — General expenses, 219. — III. Diversity in opinion as to maintenance of way, 219. — Distinction between deterioration and wear and tear, 221. — Standard of maintenance for passenger service, 223. — IV. Tabulation of various bases used for maintenance of way expenses, 225. — The train mile, 225. — V. The gross ton mile, 229. — The locomotive mile, 230. — The locomotive ton mile, 230. — The car mile, 231. — The train mile and car mile combined, 231. — The weighted train ton mile and locomotive mile, 232. — Direct expenses, 232. — Operating revenue, 233. — VI. Locomotive fuel, 235. — Effect of use of ten different bases in the Boston and Maine milk case, 238. — Cost accounting problems now being considered, 239.

I

THE increasing importance attached by the Interstate Commerce Commission to cost of service as a prime factor in rate cases is seen in many recent decisions.[1] The evidence and the briefs presented both by the railroads and by the protestants now give special prominence to expense apportionments; and certain firms of public accountants have specialized as experts in railroad rate cases.

[1] Among them the following are of special interest: Five Per Cent case, 31 I. C. C. 392; Anthracite Coal case, 35 I. C. C. 220; 1915 Western Rate Advance case, 35 I. C. C. 497; Western Passenger Fares case, 37 I. C. C. 1; Lake Erie Ports Iron Ore case, 41 I. C. C. 181; and New England Milk case, 40 I. C. C. 699.

One of the first important cases in which cost statistics played a very important part was that decided by the Wisconsin Railroad Commission on February 16, 1907. (Buell *v.* C., M. & St. P. Ry. Co., 1 Wis. R. R. C. Rep., p. 324.) The railroad company, in support of its proposed advances in passenger fares, presented elaborate statistics purporting to show that the passenger service, taken by itself and charged with its fair share of operating expenses, taxes, and charges, failed to earn a reasonable return on the investment. The computations required a separation of all of the accounts, not only between freight and passenger service, but also between Wisconsin and the other states served by the Chicago, Milwaukee and St. Paul Railway. In criticizing the methods employed by the railroad, the Wisconsin Commission laid down certain principles applying to the apportionment of income and outgo, and the decision may be regarded as a bench mark in railroad cost statistics in rate cases. In the opinion of the Commission:

> The most essential element in the fixing of a reasonable rate is the cost of service to the carrier. There are very many other facts which also should be taken into account, but none of them seems to be as vital or as necessary to a just and fair conclusion as the cost. Without some facts which indicate the approximate cost per unit of service, or per unit of transportation, it would seem to be practically impossible to say at what figures the rates should be fixed in order to yield operating expenses and a fair rate of interest on the investment.

The purpose of the present article is to discuss the various methods used by the railroads and public accountants for separating operating expenses between the freight and passenger services, and to suggest a solution for one of the most difficult of the problems. It is not the purpose of the article to touch upon the value

of cost of service as an element in rate-making.[1] Regardless of the limited application of such evidence in determining the reasonableness of rates affected also by competition of carriers, competition of markets, competition of commodities, and other factors which may have the prevailing influence, the Commissions and the Courts have decided in a long list of cases that information as to the cost of service is essential, particularly in general advances in rates. In the Western Passenger Fares case (37 I. C. C. 497), for example, the decision of the Commission apparently hinged upon the figures showing the relative remunerativeness of the passenger service compared with that of the freight service.

The railroads, therefore, are taking more interest in the problems connected with the separation of expenses. Instead of magnifying the difficulties inherent in the attempt to separate joint costs, and ridiculing the bases which have been suggested, the railroads are now making an earnest effort to devise methods to produce results which will be of value not only in rate cases but will also afford the railroads themselves valuable information of a "cost accounting" nature which heretofore many of them have lacked. Unfortu-

[1] Nor is any consideration given here to the propriety of regarding the results obtained by allocation and apportionment of expenses as "cost" figures. See article by Allen S. Olmsted, 2d, "Do 'Cost of Transportation' Exhibits in Railroad Rate Cases show Cost?" Annals of the American Academy of Political and Social Science, Philadelphia, January, 1916, Publication no. 973. Olmsted believes that the word "cost" in such cases is a misnomer. "Such computations consist of two processes. One is an *allocation* to a particular traffic of costs attributable solely to it; the other is an *apportionment* between the particular traffic and other traffic of costs jointly caused by both kinds of traffic. . . . Allocation is the assignment of facts; apportionment is the determination of policy. The former concerns itself with what is; the latter with what should be. One process consists of untwisting the intertwined but separate and distinct strands of a particular causation; the other of splitting the homogeneous fibres of a single cost jointly caused. Allocation aims to find what each service *costs;* apportionment aims to determine what each service *ought to pay*. . . . Combining the two figures seems like adding quarts to feet. The desirable course would seem to be to resolve the total 'cost' into its constituent elements, one marked 'Matter of Fact — Allocated Cost of Service' and the other labeled 'Matter of Opinion — Mathematical Photograph of Witness's Sense of Justice.'"

nately, however, little progress has been made in standardizing the accounting practice. Both as between the railroads themselves and as between the railroads and public accountants (as well as between the public accountants themselves) there is much confusion and conflict.

II

During the first seven years of the Interstate Commerce Commission's jurisdiction over the accounts and statistics of interstate carriers (from July 1, 1887, to June 30, 1894) the Commission required the railroads to report their operating expenses separately as between the freight and passenger services. Definite rules, however, were not promulgated, and much latitude was allowed the railroad accountants. The early reports of the Commission contain tabulations which purport to show not only the average revenue per passenger mile and per ton mile, but, as well, the operating expenses applicable to each unit of service. On their face, the figures gave an indication of the relative remunerativeness of each class of service, but as the experience of seven years developed serious difficulties in practice, and as the results were widely discredited both by the railroads and public regulating authorities,[1] the Interstate Commerce Commission withdrew the requirement. The *First Revised Issue of the Classification of Operating Expenses* (effective July 1, 1894) omitted any reference to the subject.

[1] "The test of actual practice fails to satisfy us that these rules are of any utility either to the companies, the states or the nation. Indeed, if not substantially correct they could not be expected to be useful and may prove positively vicious. We know what results have been reached by the application of these rules for division which are grossly erroneous not to say preposterous." From Report of Committee on Uniformity of Accounts, Proceedings of the Fourth (1892) Annual Convention of the National Association of Railway Commissions, p. 23.

Now, after a lapse of twenty-one years, during which the authority over railroad accounting has been made absolute, the Interstate Commerce Commission has renewed the requirement. Effective July 1, 1915, carriers having annual operating revenues of $1,000,000 or more, are instructed to report a division of operating expenses in accordance with the Commission's *Rules Governing the Separation of Operating Expenses between Freight Service and Passenger Service on Large Steam Railways.*

Briefly, the Commission, while avoiding extreme particularity in its instructions, lays down the general principles that:

(1) Such expenditures as may be definitely and accurately allocated should be reported separately.

(2) Such expenditures as may not be definitely and accurately allocated, but which are susceptible of apportionment on some basis which will approximately represent the facts, should be pro-rated.

(3) Such expenditures as those which defy any accurate or even any approximate allocation or apportionment should be reported as "undivided," the Commission to determine later, or as needed in special cases, how the undivided items should be split between the two classes of service.

The three divisions, then, are:

(*a*) Direct charges.

(*b*) Indirect charges susceptible of approximate separation.

(*c*) Overhead or other joint costs which are very difficult to separate.

In the first group are the wages of the locomotive and train crews, the cost of locomotive fuel, the maintenance of motive power and other rolling stock, the charges to freight claims and baggage claims, and other

minor items of expense which may be kept entirely distinct by classes of service.

In the second group are such accounts as station service, which may be directly allocated in a large part, the remainder to be divided in proportion to "man hours" in each class of service; yard service, directly allocable in part, the remainder to be separated in proportion to "locomotive hours" in each class of service.

In the third group are most of the items under maintenance of way and structures, such as roadway maintenance, the renewals of rails, ties and ballast, and the maintenance of work equipment. It includes as well all items classified as general expenses.

Throughout the maintenance of way group, which presents the most difficult problems in apportionment, the Commission requires that under each account such expenses as may be directly traced or recorded should be charged either to the freight or to the passenger service, the remainder to be regarded as joint expenses and reported as undivided. Superintendence, for example, is to be reported as undivided. With respect to maintenance of station buildings, the rules require that carriers keep a record of maintenance costs of freight stations (to be charged to freight) and of passenger stations (to be charged to passenger) and that the remainder should be pro-rated in the same proportion as the direct charges to that account. All roadway and track expenses, with the exception of yard track maintenance (which is to be recorded separately and divided between freight and passenger in proportion to switch locomotive miles in each class of service) and maintenance of roadway buildings, are to be reported as undivided. Maintenance of water and fuel stations is to be divided on the basis of the freight and passenger

proportions of fuel costs. Maintenance of shops and engine houses is to be divided in the proportion which the freight and passenger services assume in the total charges to the maintenance of equipment group of expenses. The cost of maintaining grain elevators, storage warehouses, and the like, is to be assigned directly or apportioned according to the facts in individual instances. The maintenance cost of telegraph and telephone lines, and of signals and interlockers, is to be divided on the basis of transportation train miles. Power plant maintenance is to be assigned according to facts in individual instances. Maintenance cost of paving, roadway machines, etc., and the charges to injuries to persons, insurance, stationery and printing, and other maintenance of way expenses are to be reported as undivided, unless a determination of facts in individual instances makes definite allocation possible. The cost of maintaining joint tracks and other joint facilities should, as far as practicable, be treated individually according to the use made of them by the reporting carrier, regardless of the use made of them by other carriers.

Under maintenance of equipment expenses one item only (work equipment — repairs, depreciation and retirements) is to be reported as undivided. The maintenance of work equipment is to be regarded as an undivided expense and should be treated in the same manner as roadway and track costs. With respect to the maintenance and replacement of locomotives and cars (other than work equipment) the railroads are required to keep their accounts in such form that the actual cost of repairing and replacing of freight locomotives and cars shall be charged to the freight service, and that the similar costs for passenger locomotives and cars shall be charged to the passenger service. In the

case of locomotives used in both classes of service, the expense is to be pro-rated on the basis of locomotive miles in each class of service, altho permission is given to use "some arbitrary deemed by the carrier to be applicable, as, for example, by making one and a half passenger locomotive miles equivalent to one freight locomotive mile." The cost of maintaining locomotives used in mixed train service is to be apportioned on the basis of car miles in mixed trains (unless the carrier is able to make a more nearly accurate estimate), and the maintenance cost of switch locomotives is to be divided according to the freight and passenger switching locomotive miles. For the latter account the railroads are permitted to take all yards together annually. This is essentially a "locomotive hour" basis, since switching locomotive mileage is computed on the arbitrary basis of six miles per hour, according to the rules of the Commission pertaining to the compilation of locomotive, train and car mileage.

For the charges on account of depreciation and retirements of locomotives and cars the rules require an assignment "direct as far as practicable," and an apportionment of the unassigned remainder "according to the mileage made in each class of service by the individual locomotives (or cars) or by classes of locomotives (or cars)." In the case of locomotives alone "if this method is not practicable, then the division should be made according to the aggregate freight locomotive and passenger locomotive ton mileage of the locomotives affected for the year, or upon some other basis deemed by the carrier to be more nearly accurate."

Charges to superintendence (maintenance of equipment), shop machinery, power plants, floating equipment, miscellaneous equipment, injuries to persons, insurance, stationery and printing, and other main-

tenance of equipment expenses, are to be apportioned on the same basis as the freight and passenger proportions of repairs of locomotives and cars. The same basis is to apply to maintaining joint equipment at terminals "unless a knowledge of local conditions enables a carrier to make a more nearly accurate estimate. Each terminal should, as far as practicable, be treated individually."

The entire group of traffic expenses is to be assigned directly. This is usually practicable, in as much as the freight traffic department and the passenger traffic department are ordinarily distinct and separate below the executive offices. Common traffic expenses are to be apportioned on the basis of the directly assigned expenses in this general account.

In the group of transportation expenses no items are to be reported as undivided. The cost of dispatching trains is to be apportioned according to transportation train miles. The cost of station employees and station supplies and expenses is to be charged according to direct analysis, the common expenses to be apportioned as in the case of superintendence (to be mentioned later). Charges to weighing, inspection and demurrage bureaus, and to coal and ore wharves operation, are to be assigned directly. The yard group of expenses is to be assigned directly as far as practicable, the unassigned remainder to be apportioned in accordance with the freight and passenger yard switching locomotive miles of the year, each yard to be treated individually, if practicable, but at least excluding the mileage of those yards which have been treated as wholly freight or wholly passenger. In the cost of operating joint yards and terminals, each yard or terminal is to be treated individually, and a separation made according to local conditions.

The wages of train enginemen, motormen and train crews, the cost of fuel, water and other locomotive supplies, and the cost of train supplies, are to be assigned directly as far as practicable, common expenses to be divided on the basis of the direct assignments in each account. The charges to road engine-house expense are to be divided according to the number of engines handled for each class of service, an arbitrary to be used, if deemed proper, to give freight locomotives a greater weight than passenger locomotives. Operation of sleeping cars, express service and baggage claims are to be charged direct to passenger. The cost of settling freight claims is to be charged direct to freight. Charges to signal operation and crossing protection are to be apportioned on a transportation train mile basis. The expense of clearing wrecks is to be assigned directly, as far as practicable, according to the service in which the accident occurred and not according to the responsibility for the accident, the unassigned remainder to be divided (like superintendence) on the basis of the entire assignable items in the transportation expenses group. The charges to damage to property, damage to live stock on right of way, and injuries to persons, are to be treated the same as clearing wrecks. The remaining transportation accounts — namely, superintendence, train power purchased and produced, operating floating equipment, stationery and printing, insurance, and other transportation expenses — are to be divided according to the freight and passenger proportions of the aggregate of the assignable items in the transportation group. The cost of operating joint tracks and facilities is to be similarly treated "unless a knowledge of local conditions enables the carrier to make a more nearly accurate estimate."

Transportation expenses of water lines, miscellaneous operations, and general expenses, are to be assigned directly as far as practicable, the remainders to be reported as undivided " unless a knowledge of local conditions makes possible a more nearly accurate estimate."

Carriers are required to indicate the total amount of credit which should be given to the freight service for work (such as carrying company fuel and other company supplies) performed for the passenger service, and *vice versa.*

III

In the hearings on this subject, following the publication by the Commission of the tentative rules for separating expenses, there was an apparent acceptance of the principle that such separation is necessary, and no serious differences in opinion developed as to the methods proposed, except with reference to those applying to maintenance of way and structures expenses which are common both to freight and passenger services. The representatives of state commissions advocated the use of the " gross ton mile " basis, while the representatives of some of the railroads favored " engine ton miles." By gross ton miles is meant the weight of the train behind the locomotive tender — cars and contents — times the miles made by the train. By engine ton miles is meant the tons of locomotive — ready for service (excluding the tender) — times the miles made by the locomotive. In both cases the ton is taken as 2,000 pounds.

In the opinion of the Commission, as expressed in the foreword to the rules as finally promulgated, the facts and arguments presented did not at that time warrant the final approval of the Commission of any one of the

three bases suggested, namely, gross ton miles, engine ton miles, or direct charges, as the divisor for joint maintenance of way expenses. Carriers are required, until further notice, to compute engine ton mile data, and the relative merits of the three bases, or modifications thereof, are to be further considered by the Commission with the aid of the statistics thus made available.

The absence of definite instructions to govern in the controversial features connected with the separation of the maintenance of way expenses is unfortunate. The Commission, evidently, is unwilling as yet to commit itself to hard and fast rules. In recent cases (particularly the Western Passenger Fares case to be referred to later) it has taken pains to make clear that where apportionments of expenses have been accepted, the Commission has not thereby given approval to any particular formula for maintenance of way expenses. Apparently, further time is desired to consider conflicting evidence as to the fairness and propriety of the alternative bases, and to observe the effect of the 1915 rules pertaining to the subject. In the meantime, the railroads hesitate to commit themselves to any one formula, fearing that it may not have a place in the next edition of the Commission's rules. The separation of the maintenance expenses, and necessarily of the total operating expenses, is but partially accomplished, and the tendency on the part of the railroads will probably be to report a large part of expenses as "undivided."

As has already been stated, it is in connection with the separation of maintenance of way expenses that there exists the greatest diversity and divergence in opinion and practice. Such items as roadway maintenance, tie renewals, and repairs to bridges, trestles, and culverts, form the most baffling of apportionment problems.

The cost of maintaining the roadbed and track structures is influenced by many factors. These factors may be classified into at least three groups:

(1) Natural deterioration or disintegration; caused by the elements.

(2) Wear and tear; caused by locomotive and car use.

(3) Standard of maintenance; determined by the policy of the management.

The effect of the elements is seen in the decay of ties, the wasting or fouling of the ballast by rain, high water, and winds, the clogging of the ditches, the erosion of slopes and embankments, the corrosion of rails, rail fastenings, tie plates, bridge members, and other steel structures, and the deterioration of buildings and other wooden structures. This deterioration or waste is entirely independent of and bears practically no relation to the use to which the track and structures are put.[1]

As to what proportion of the cost of repairs and renewals is due to the action of the elements and what proportion is due to the wear and tear of train traffic, there are no exact data, and the opinions of engineers and accountants differ widely. In the Buell case [2] the Chicago, Milwaukee, and St. Paul Railway set the percentage due to the elements at 25 per cent. To this the Wisconsin Commission properly took exception, as the weight of opinion is decidedly against such a low percentage. Woodlock, in his monograph on *Ton Mile Cost* estimates that 90 per cent of the cost of maintaining the roadbed is due to natural deterioration. Other authorities quoted by the Wisconsin Commission

[1] The standard of maintenance will naturally be higher on the road with heavy traffic, and the point at which deterioration will cause a removal and renewal of parts will be reached sooner than on the road with light traffic.

[2] 1 Wis. R. R. Com. 324.

support percentages similarly high. For tie renewals, Woodlock charges 67 per cent to decay. For bridge maintenance he sets the percentage due to the elements at 90 per cent. The Wisconsin Commission decided that in the case of ties between two-thirds and three-quarters would be fair, and as to bridge maintenance costs (consisting largely of charges for painting) the percentage given by Woodlock was approved.

As a practical matter little is to be gained by attempting to separate maintenance costs between those due to the elements and those due to traffic, unless, as was true in the Buell case, different bases were used in separating the two component parts of maintenance expenses between the freight and passenger services. In some computations the cost due to wear and tear was divided according to use, as expressed by locomotive or train miles or combinations of the two, and the cost due to elements was divided on the basis of road or track miles, or on gross revenues. In the Buell case the Wisconsin Commission adopted such a method because it was considered unfair to the state of Wisconsin, in which the traffic density of the railroad was greater than in other states, to charge that state with its train mile proportion of all maintenance of way expenses when only a part, and a relatively small part, was due to the wear and tear of traffic. The Commission, therefore, decided that the wear and tear proportion only should be apportioned on train miles and that the remainder should be apportioned on road miles. This method, of course, had the effect of reducing the charge to Wisconsin.

The wear and tear of the roadbed, track structure, and bridges, trestles and culverts are caused by the action of locomotive and car wheels. The degree of wear and tear, and of stress or shock, varies in some degree with

the wheel load, the diameter of the wheel, and the speed. It is influenced also by the design of the locomotive and cars in such particulars as length of rigid frame, counterbalances in driving wheels, quality of springs and riding characteristics of trucks. The wear and tear and shock are felt first and in greatest degree by the rail and rail fastenings; next by the bridges and trestles; and least by the ballast and roadbed.

The policy of a railroad company with respect to the standard of roadway maintenance is influenced by the financial ability of the company and by the character of the traffic. A prosperous road with a dense passenger traffic usually adopts a higher standard of maintenance, and expends more money on that account, than the poorer road with little passenger service. So far as safety in operation is concerned, there may be little difference between the two roads. Looking at the subject from the viewpoint of cost accounting, however, we are perplexed in our efforts to determine the proper division of the extra cost on the first road. How are we to determine just what the excess amounts to? Is it proper to charge all of the excess to the passenger service when the freight service is benefited as well? Modern signaling, as an example, is usually regarded as an essential to safe passenger train operation, yet the cost of these signals may be and usually is fully justified by the assistance which the signals afford to freight trains and the consequent increase in the capacity of the road to move more trains. It may be fairly alleged, however, that higher standards of maintenance, such as the use of crushed stone ballast, are due principally to the demands of the passenger service.

In testifying before the Interstate Commerce Commission in the Western Passenger Fares case in 1915, Mr. George R. Martin, then Comptroller and now Vice-

President of the Great Northern Railway, stated (pages 2315–16, stenographer's record):

> Then if you are going to put on a fast, heavy passenger service, you would have to raise the standard of maintenance to another level, and the difference between this first level and the second level is entirely on account of passenger train service that is going over that line. On the main line, where the through, heavy passenger trains run, beyond a certain point or standard of maintenance there is an expense up to another standard which is entirely chargeable to passenger service, in my opinion. . . . [To raise the standard] ordinarily you would put in heavier rail, probably increase the number of ties to the rail, increase the quantity of ballast, and in connection with that, probably it would be necessary to widen the banks. The same thing, of course, applies to the bridges. . . .
>
> There would be a greater lift of ballast and it would come out more as a shoulder beyond the ends of the ties. The re-working that you speak of, would, of course, be an improvement; that is, it would keep the track in better shape; the more labor you put on to keep up the roadbed and to keep the shoulders in place so the track will hold where it is, where it should be, of course, brings the track to a better standard than it would be if you did not re-work it.

The classification of the Interstate Commerce Commission ignores the factors of natural deterioration and standard of upkeep. As a rule, too, the railroad accounts and public accountants take no specific account of these influences on maintenance costs. In a few cases, such as the Buell case already mentioned,[1] a distinction is made between wear and tear and deterioration, and the two elements are recognized by different methods of apportionment.

[1] See reference to Buell case on p. 210. Similar distinction made in statistics presented in the Class Rate Advance case (I. C. C. Docket 3500). The Rock Island maintenance expenses were apportioned on three bases: (1) that used by the Rock Island in its own accounts; (2) that provided by the Nebraska formula; and (3) that provided by the Missouri formula. Under bases 1 and 3 the total maintenance of way expenses were apportioned on train miles, but under the Nebraska formula 10 per cent of such expenses were divided on train miles and 90 per cent on operating revenues.

In the Railway Mail Inquiry, 1912, the Post Office Department, in making its own separation of expenses from the figures presented by the railroad companies, divided certain maintenance expenses 10 per cent on train miles and 90 per cent on direct charges under maintenance of equipment and transportation.

IV

Among the various bases which have been used or suggested from time to time, the following may be mentioned:

(1) Train miles.

(2) Train miles and switch locomotive miles combined.

(3) Train ton miles (gross ton miles).

(4) Locomotive miles, road service only.

(5) Locomotive miles, road and switching.

(6) Locomotive ton miles.

(7) Car miles.

(8) Train miles and car miles combined.

(9) Weighted train ton miles and locomotive miles combined.

(10) Direct expenses.

(11) Operating revenues.

(12) Tons of fuel consumed by road and switch locomotives.

The train mile basis is the oldest and has been that most generally used. It was prescribed by the Interstate Commerce Commission in its first (1887) classification of expenses, and prior to then had been used by the Pennsylvania Railroad and other railroads in separating their expenses. It was understood, however, and the Pennsylvania Railroad has always been careful to make the qualification, that the results were worked out only for the purposes of administrative control of expenses, and were not in any sense to be considered "costs" from which any conclusions could properly be reached in considering rates.

When the train mile basis was first used by the Pennsylvania Railroad the differences between the average

freight train and the average passenger train were not so great as they are at the present time. Freight trains then were little longer or heavier than passenger trains. Approximately the same type of locomotive was used interchangeably in both classes of service. The train mile then was a fairly accurate unit for measuring joint costs. It was believed that the greater speed of the passenger train justified a charge equal to that levied against the heavier but slower moving freight train.

At the present time the average freight train consists of approximately thirty-six cars, loads and empties, which weigh approximately 1200 tons. The average passenger train has about six cars which weigh approximately 380 tons.[1] The weight of the average freight train, therefore, is more than three times the weight of the average passenger train, and the former has about six times the number of cars.

It is obvious that the use of the train mile basis charges the passenger service as much for six cars or 380 tons as it charges the freight service for thirty-six cars or 1200 tons. This charges too much to the passenger service, even when an allowance is made for its greater speed. The speed of the passenger train undoubtedly causes additional stress and shock, and adds to wear and tear, but it is too much to say that the speed factor equalizes the weight factor, or that the effect on maintenance costs by either train is about the same. If that were true, it would follow that the lighter passenger train causes three times as much damage *per ton of train*, or between four and five times as much *per wheel*.

The Wisconsin Commission, in considering the Buell case, asked Professor W. D. Pence, of the engineering department of the University of Wisconsin, for his

[1] This average is for all passenger trains — through, suburban and branch line. A modern through express train, consisting of eight steel cars, weighs about 550 tons.

opinion on the relative destructiveness of passenger and freight trains. His report, as summarized by the Commission, was:

The wear of the wheel tread is a good basis for estimating the wear of rails.
The wear of the drivers is more rapid on freight than on passenger locomotives.
The wear of drivers on passenger locomotives is not increased as speed increases.
Hammer blows of drivers is frequently more injurious to rails with freight service than with passenger.
Passenger rolling stock is less severe on the track and structures than freight cars.
Rail deflections and roadbed pressures do not increase directly as the speed.
Cost of raising and tamping track is not increased with increased proportion of passenger trains.
Tie renewals are chiefly due to decay.

Notwithstanding this definite expert testimony, there is force to the contention that the element of speed should have serious consideration, even tho with the average train at average speed this factor is not a controlling element in maintenance expenses. The design of the locomotive aims to compensate, in some measure, for the effect of speed. Passenger locomotive drivers are larger and are counterbalanced for speed.

The views in opposition to the testimony of Professor Pence were well expressed by Mr. George R. Martin in the Buell case. Mr. Martin, while then and now in charge of the accounting department of the Great Northern Railway, has had extensive railroad experience in the operating department, and at one time was general superintendent of the Montana Central Railway in charge of both operation (including maintenance) and construction. His views, as a broadly trained operating and accounting officer, are entitled to respect. In his testimony he stated (page 2313, stenographer's record):

The repairs of the track structure, of which you speak, are to my mind caused to a greater extent by the speed than by the weight; that is, the speed of the trains in passing over the track has a great deal of effect in the wearing out of the track, and that refers very particularly to the portions of the track where there are breaks in the running surface. Of course, that means every joint or every frog, or wherever there may be a break in the running surface. . . . The speed involves a blow at the joints and breaks them down, both as to the rails themselves and the rail fastenings and the support that is given by the ballast and the sub-grade.

The advocates of the train mile basis contend further that it is the locomotive which causes the greatest wear and tear to the track. This contention, too, has force. Engineering authorities support the general statement, but differ in their estimates of the weight to be given.[1]

The subject has had the attention of the American Railway Engineering Association. In 1913 a committee of that association presented an elaborate report, which suggested a method for "weighting" locomotives and cars in the two classes of service according to their relative destructiveness on track and structures. The committee's recommendations stated in ratios, were that:

Ton miles in freight service should be considered as 100.

Ton miles in passenger service should be considered as 200.

Locomotive miles in freight service should be considered as 200.

Locomotive miles in passenger service should be considered as 400.

[1] "The locomotive alone causes by far the greater portion of this wear — how much is not positively known. Freycinet, a French engineer, writer, and politician of much prominence, recently Minister of Public Works, estimates that the locomotive does three-fourths of the damage and the train itself only one-fourth. Launhardt, a German writer on the subject, after noting the fact that the locomotive and tender together constitute only one-fifth of the total weight of train on the Prussian state railways (it would be considerably less in this country) considers that half the wear is due to the locomotive and tender and half to the train. This in all probability is a very moderate estimate." A. M. Wellington, Economic Theory of Railway Location, 6th ed., 1906, p. 122.

The association declined to commit itself to the formula. "There was vigorous opposition to these views, some engineers pointing out that although passenger traffic, as a rule, required more expensive roadbed and better up-keep, the freight trains were relatively as destructive of track, if not more so of track structure. The whole matter was, therefore, referred to the committee for further study, and no subsequent report has yet been made." [1]

V

The gross ton mile basis (total weight of train — cars and contents — multiplied by the train mileage) is highly favorable to the passenger service. This method was advocated by representatives of certain state commissions, and is approved by some railroads which keep such statistics currently as a check on operating efficiency. The average passenger train has less than one-third the weight of the average freight train. Moreover, it takes no account whatever of speed, nor of the weight and greater destructiveness of the locomotive alone as compared to the wear and tear of the cars alone. It is hardly probable that the gross ton mile basis will ever be seriously considered as a basis for the apportionment of expenses, although it was suggested by the public accountants who testified for the protestants in the Western Passenger Fares case.

Even were the basis otherwise unobjectionable, its propriety may be questioned on technical grounds, inasmuch as it is practically impossible to ascertain the weight of the passenger train "load." No record is kept of the weight of passengers, baggage, mail, express,

[1] "Apportionment of Railroad Expenses and Property Values on Basis of Use," A. M. Sakolski, Journal of Accountancy, August, 1916.

or company supplies, transported in passenger trains. These must be estimated.

The road locomotive mile basis gives results substantially similar to those obtained by the train mile divisor, but it is slightly less unfavorable to the passenger service, since it takes account of helper and "double-header" locomotives which are used to a greater extent in freight service. Yet it has the defect of giving an equal charge to the passenger locomotive and the freight locomotive. It takes no account of the weight of the locomotive or its speed, and ignores (as do many other suggested bases) the effect of switching locomotives on yard tracks and on main tracks within yard limits.

To relieve the passenger service of the burden last referred to, another method has been used: road and and switching locomotive miles combined. Since the greater part of switching locomotive miles are made in freight service, its inclusion tends to lighten the charge to passenger service. If the elements of weight and speed are to be left out of account, the road and switch locomotive mile basis is to be preferred to either the train mile, gross ton mile, or road locomotive mile basis.

The locomotive ton mile basis, defined by the Commission as "the product obtained by multiplying the number of tons (2000 lbs.) in weight of the locomotive ready for service (but exclusive of the tender when the tender is a separate car) into the number of locomotive miles made by it," is the basis which was suggested by many railroads in the hearings on the subject before the Interstate Commerce Commission prior to its promulgation (in 1914) of the existing rules. The theory is that the major part of the wear and tear is caused by the locomotive, and is in some degree proportional to

its weight. Freight locomotives as a rule are heavier than passenger locomotives, particularly the freight locomotive used to haul full tonnage trains in slow service. This feature automatically takes some account of the greater tonnage in long freight trains, but the difference in the weights of the two locomotives is relatively less than the difference in the weights of the trains. The locomotive ton mile basis to that extent, therefore, favors the freight service. Its advocates claim, however, that the apparent favoritism is fair because of the greater speed of passenger trains.

While it is true that the locomotive ton mile basis was proposed by railroad representatives in the hearings before the Commission, it has by no means unanimous railroad approval. The Committee on Corporate, Fiscal and General Accounts of the American Railway Accounting Officers, has gone on record, since the promulgation of the Commission's rules, as refusing to endorse the basis until more is known of the real relationship between weight of the locomotives and train speed.

The car mile basis has had but limited application. Obviously it is unfair to the freight service, as the average freight train has about six times as many cars as the average passenger train. The car mile basis ignores the differences in train speed and in the weight of the cars. It spreads the effect of the freight locomotive over thirty-six cars, while the effect of the passenger locomotive is distributed over but six cars.

The combination or average of train miles and car miles is occasionally used as a compromise. The train mile basis burdens the passenger service; the car mile basis burdens the freight service. The average of the two may equalize the advantages and disadvantages, but it must be regarded as an empirical makeshift.

The " weighted " train ton and locomotive mile basis is that referred to earlier in this article as the suggestion of the committee of the American Railway Engineering Association. So far as the writer knows this basis has not been tested in practice, and it failed, when presented, to receive the endorsement of the association.

The direct charges basis calls for the division of joint expenses in the maintenance of way group in the same proportion that the direct charges to freight and passenger bear to the total expenses directly allocated. Direct charges include such items as train wages, fuel, allocable station and yard expenses, and the cost of maintaining locomotives and cars. The use of this method is justified on the theory that joint costs which do not lend themselves to any method of exact apportionment should be divided between the two classes of service in the same proportion as the total of the costs which may be directly and accurately assigned. We *know* that it is fair to both classes of service to charge each with its directly allocable expenses; we may *assume* that it likewise is fair similarly to divide the joint expenses.

The same theory is applied to such expenses as are common to one group, in which the major part may be directly allocated. For example, the cost of superintendence under maintenance of equipment is divided in proportion to the direct charges for the maintenance of locomotives and cars. In such cases there can be no objection to the plan, and indeed no better has been suggested. But the propriety of applying the proportions of direct charges in the transportation group alone, or in the transportation and maintenance of equipment groups together, to the common expenses in the maintenance of way group, is questionable. The proportion of direct charges to the passenger service in transporta-

tion expenses is likely to be higher than its proportion in maintenance of equipment expenses, and the result of applying the direct charges method to common maintenance of way expenses depends largely upon whether the ratio is confined to transportation direct charges or to transportation and equipment direct charges combined. In the New England Milk case, to be referred to later in detail, the figures indicate that for the road in question, the Boston and Maine, the passenger proportion of direct transportation charges was 46.8 per cent, while the passenger proportion of equipment maintenance direct charges was 29.9 per cent. Combining the two groups of direct charges gave the passenger proportion as 39.6 per cent. As a coincidence merely, that percentage happens to agree closely with the results obtained under the train and car mile, the operating revenues, and the fuel consumption bases.

Operating revenue, as a basis for the division of joint maintenance of way expenses, has been used in isolated cases, and is occasionally suggested. Its only support is the theory of "ability to pay." Maintenance of way expenses, in the main, are joint costs which are not susceptible of any exact division according to use; therefore, according to this theory, they should be recorded as "overhead" expenses and distributed according to the earning power of the two classes of service. It is plain that this involves reasoning in a circle, and it has no justification in determining the reasonableness of rates under investigation. A reduction in the rates in either class of service would have the effect of reducing the apparent cost of that service.[1] If, for example, in a given case, where the total charges to

[1] "If the property is to be divided according to value of use, it is plain that the gross earnings method is not an accurate measure of value.

"The value of use, as measured by the return, cannot be made the criterion when the return is itself in question." Justice Hughes of the United States Supreme Court in the Minnesota Rate case.

each class of service were equal, the passenger rates were reduced without reducing or increasing the volume of passenger traffic, and caused a reduction of 10 per cent in passenger revenue, then the charge to the passenger service (or the apparent "cost") would be reduced 2.6 per cent and the charge to the freight service would be increased 2.6 per cent,[1] even tho the actual expenses in either class were not affected in any way.

In the Western Passenger Fares case the Interstate Commerce Commission, after considering the several methods advocated by the accountants of the carriers and the protestants for dividing maintenance of way expenses, rejected all of them (including locomotive ton miles, gross ton miles, revenue train miles and direct charges in train service and equipment maintenance) and used a direct costs basis of its own, which embraced only seven accounts, viz.:

Road enginemen.
Fuel for road locomotives.
Water for road locomotives.
Lubricants for road locomotives.
Other supplies — road locomotives.
Road trainmen.
Train supplies and expenses.

The Commission accepted the railroads' allocation or apportionment for all expenses except those under maintenance of way, which the Commission divided on the direct costs method just described. In doing so the Commission stated:

> Our decision to use this method in this case must not be regarded as conclusive on our part of the method that should ultimately be used for the division of the maintenance of way and structures

[1]

	Before reduction in rates	*After reduction in rates*
Passenger revenue	100 or 50%	90 or 47.4%
Freight revenue	100 or 50%	100 or 52.6%
Total revenue	200 or 100%	190 or 100 %

expenses between passenger and freight. The objections against the direct charge method are known and appreciated. If, for example, a marked increase in wages of enginemen on passenger trains takes place, the result under this method is to increase the amount of unallocated expenses assignable to passenger business, while the actual utilizations of the track and structures by the two branches of the service remain unchanged. We are using these direct costs in this instance to determine the apportionment of unallocated expenses between passenger and freight because the objections to this method seem less forceful than those that have been urged against any of the other methods proposed.[1]

The Commission's decision to use this selected direct charges method in that case is interesting, as it is of comparatively recent date (decided December 7, 1915) and, notwithstanding the statement that it "must not be regarded as conclusive" it may give some indication of the trend of thought in the minds of the commissioners and their statisticians.

VI

In the New England Milk case (40 I. C. C. 699, decided July 11, 1916) the writer was engaged by the Boston and Maine Railroad to prepare its statistics pertaining to the milk revenue and the proportion of expenses which properly should be apportioned to the milk service. The Boston and Maine handles milk both on passenger trains and freight trains. It was necessary, therefore, first to divide expenses between passenger and freight, and then to apportion the charges in each class of service to the milk traffic in that service.

In the study of the problem it occurred to the writer that the tons of fuel consumed by road and switch locomotives should furnish the least objectionable and the most defensible basis for apportioning the joint expenses under maintenance of way. The decision in the Western Passenger Fares case was published when

[1] 37 I. C. C. 23.

the figures were being compiled, and it seemed to the writer that if the Commission could tentatively approve a direct charges method which essentially included only fuel and wages of train and engine crews (since water, lubrication, and other supplies are usually divided arbitrarily on fuel issues, locomotive miles, or locomotive ton miles) they could also approve the basis of fuel issues alone. The tonnage of fuel consumed is unaffected by variations such as those mentioned by the Commission.

Before discussing the fuel basis, it may be stated at this point that while the Commission conceded what the Boston and Maine statistics purported to show, that is, that the milk traffic, under the rates then in effect, was not assuming its fair share of expenses, yet it did not approve the fuel basis as a divisor for maintenance of way expenses. Nor did the Commission suggest an alternative method.

So far as the writer has knowledge, fuel consumption as a basis for dividing maintenance of way expenses has been used only in the case just referred to. It is prescribed by the Commission as the divisor for the cost of maintaining water stations and for the division of the cost of water used by locomotives. The protestants in the New England Milk case, therefore, were justified in characterizing the fuel method as "novel and untried."

The theory upon which the fuel basis is offered as a substitute for train, locomotive and car miles or combinations thereof, is that it is a more scientific measure of use. Fuel consumption, in a large degree, is proportional to the horsepower developed. Horsepower is the resultant of locomotive tractive force and speed.[1] A

[1] The formula is:

$$\text{Cylinder horsepower} = \frac{(\text{Tractive force in lbs.}) \quad (\text{Speed in miles per hr.})}{375}$$

given number of horsepower may be utilized in hauling a heavy train at slow speed or a light train at high speed. Speaking in general terms, in locomotives of similar design, the horsepower developed is closely related to the volume of steam used in the cylinders, and the steam production in boilers of similar design is in turn closely related to the amount of fuel consumed in the firebox. There is, however, a critical point in the piston speed at which the horsepower efficiency is greatest.

Since the horsepower developed is directly proportional to the speed of the train, it follows that the fuel consumption by a given train increases somewhat in proportion to the speed of the train. Fuel consumption, however, does not vary directly with speed, yet it bears a close relation to it. It is impracticable to show the relation exactly by formula, because of the many variable factors which affect train resistance and locomotive boiler and cylinder efficiency; but the indications of many tests support the statement that as between trains of different classes on the same division, the fuel consumption, as a measure of train horsepower, automatically equates for both weight and speed. It takes account of the weight or power of the locomotive, the weight or number of cars, and the speed of the train. It affords, then, the only least common multiple yet suggested that has some claim to the term scientific.

From an accounting viewpoint the fuel basis is desirable as it requires no special compilations when (as should be done for other purposes) fuel consumption statistics are kept separate for the three classes of service — freight, passenger, and switch. The use of the locomotive ton mile basis, on the other hand, requires the keeping of special statistics for that purpose alone, and, moreover, the basis is less scientific.

The range of difference in the results obtained by using several of the bases which have been discussed, may be seen if they are applied to the maintenance of way and structures expenses of the Boston and Maine Railroad (using the figures contained in the evidence presented in the New England Milk case). The total charges to that group of expenses during the year ended June 30, 1915, were $7,118,602. A small part of these expenses were allocated directly, but for the purpose of illustration we will apply the several methods to the total of the entire group of maintenance of way and structures. They are arranged in the order in which they burden the charge to passenger service.

Basis	Chargeable to Passenger Service	
	Per cent	Amount
Revenue train miles	60.7%	$4,320,991
Revenue road locomotive miles	57.1	4,064,722
Revenue road locomotive ton miles	53.0	3,772,859
Direct charges; transportation costs only	46.8	3,331,506
Revenue train miles and car miles	40.6	2,890,152
Fuel consumption; road and switch locomotives	40.0	2,847,441
Direct charges; transportation and equipment	39.6	2,818,966
Operating revenues	39.3	2,797,611
Gross revenue train ton miles (estimated)	33.3	2,370,494
Revenue car miles	20.6	1,466,432

The difference between the charge to passenger service on the train mile basis, $4,320,991, and the charge on the car mile basis, $1,466,432, is nearly three million dollars. It will be noted that there is little difference in the results under four of the bases, viz., train miles and car miles combined, direct charges under transportation and equipment maintenance, fuel consumption, and operating revenues. The Boston and Maine exhibits in the milk case were computed under the fuel consumption basis.

If the perplexing difficulties surrounding the apportionment of maintenance of way expenses can be satisfactorily overcome, the problems connected with the division of other operating expenses are comparatively easy. The rules of the Commission applying to maintenance of equipment, traffic, transportation and general, are sound and workable. They have been described earlier in this article.

As stated in the beginning, the scope of this article is purposely confined to the one subject of separation of operating expenses between the freight and passenger services, and to suggest the fuel basis as the least indefensible divisor for joint maintenance of way expenses. To pursue the subject further would require an extended discussion of two general problems closely allied to the freight-passenger apportionment, viz., the separation of expenses by states, and their separation between terminal and line. Or we might go further and undertake a discussion of "splitting the homogeneous fibres of a single cost jointly caused" in attempting to ascertain the "cost" of hauling a particular commodity.

These problems are now under discussion in an important rate case in Central Freight Association territory. The railroads in interest are attempting to work out an assignment of expenses:[1]

(1) To States.
(2) Between line (or hauling expense) and terminal (or station expense).
(3) Line and terminal between freight and passenger.
(4) Freight — line and terminal — between state and interstate.
(5) Passenger — line and terminal — between state, interstate, and mail and express.

[1] This assignment follows closely the Oklahoma formula which is well described by Hooper (Railroad Accounting, chap. 15).

The railroads in eastern territory are now engaged in a study the results of which may throw some light on the moot point of the proper spread between the rates on car-load and on less-than-car-load shipments of the same commodity.

The railroads of the entire country are confronted with the necessity for preparing figures which will show the relation between the cost of carrying the mail and the revenue under the new car-space basis.

These cases give some idea of the far-reaching importance of the apportionment of operating expenses. The primary separation between passenger and freight is only one step in the process. Each additional step presents its new problems. It is desirable, therefore that the Commissions, both State and Interstate, and the railroad accounting officers, should make a serious effort to harmonize conflicting ideas and practices, and to agree upon some definite and comprehensive plan of expenses apportionment.

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WORK AND PAY: A SUGGESTION FOR REPRESENTATIVE GOVERNMENT IN INDUSTRY[1]

SUMMARY

I. The determination of work; job analysis, 242. — The several parties concerned in job analysis, 243. — A Determining Board representative of these parties, 244. — Length of working day, 245. — II. How much pay? 247. — Payment for risk to capital, 248. — Workers also assume risk, 249. — Other elements of cost; interest and dividends, 250. — Depreciation, cost of materials, 251. — This procedure the reverse of that usually followed, 252. — Salaries and wages the residuum, 253. — Wages settled by the Wage Board, 254. — Risk likely to be more frankly considered, 256. — Summary and conclusion, 257.

THE conflict in industry today centers about two distinct, altho closely related, problems — the determination of a reasonable day's work and of a reasonable day's pay; each of which can be adequately stated only when viewed in the light of the other. Reduced to simplest terms, the two-fold question is this: first, how can we determine a satisfactory day's work from the point of view of health and productivity; secondly, on the basis of such a determination of daily achievement, what what shall be the pay for it? An intelligent attack on these problems involves: (*a*) the obtaining and use of

[1] The major part in the preparation of the first draft of this paper was taken by Mr. Valentine, whose much lamented death, November 14, 1916, prevented collaboration on his part in its revision. The idea of separating the two fundamental problems — work and pay — was his; and it was he who suggested the establishment of two distinct boards, a Determining Board and a Wage Board. His experience as Director of the Joint Board of Protocol Standards of the Dress and Waist Industry of New York City had strengthened his faith in the essential principles involved, and he had submitted to the employers and the union in that industry recommendations based on them.

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data from exhaustive, objective studies of definite jobs; and (*b*) the creation of certain forms of organization which, in the conclusions based on such studies, will register the interests and attitudes of all concerned.

I. The Determination of Work

To identify all the elements working immediately and potentially to determine what a given job and the attendant conditions are and shall be, requires intensive study. To such research the name "job analysis" is here given. We shall use it throughout this discussion as meaning the exhaustive statement of every item involved in a piece of work itself and in its relations to other jobs in the organization where it exists, with especial emphasis on the effect of work upon the worker.

Job analysis includes time study, motion study, fatigue study. It embraces all the complex facts of working conditions, such as labor legislation; labor turnover in the given plant and in the industry as a whole; competence of management; living provisions — in short, all the many factors which affect the job and the worker. The job analyst makes a study of "job ratios" — i. e., as accurate an estimate as possible of the comparative difficulty, disagreeableness, and need of dexerity inherent in the specific piece of work. By estimating the maximum amount which the best worker or workers might achieve under the best conditions, job analysis establishes a tentative standard of output, and against this standard grades the workers of varying degrees of skill and estimates the relative amounts of output which can in all fairness be expected from them under actual conditions. This sketch of job analysis, its purpose and possibilities, will suggest some

of its significant values and uses. To know what the elements of a job are, must always be the first step toward determining whether the particular piece of work is necessary, how it affects the worker, and what degree of skill and endurance it requires.

Job analysis, like time study,[1] cannot, however, be entrusted to employers alone. For, in the light of the analysis, redefinitions of work and readjustments of methods may seem urgent of adoption which are so radical in character, so far-reaching in results, that their introduction can only be made with safety to the worker when his judgment on the matter is utilized and his consent secured. The worker must have protection. In the long run this protection cannot be furnished by someone else. One's interests can be permanently and satisfactorily safeguarded only by one's self or one's accredited representative. Without this self-protection trouble is bound to arise sooner or later. It is only a question of time when the unprotected or the employer-protected worker is either stirred to revolt or drained of energy, vitality, and self-respect.

This being the case, we face the second part of our first problem, which is to suggest the forms of organization necessary to voice the worker's interests where job analysis is adopted. Once known, the interests not only of the workers but of all can be drawn into the open and assured an adequate voice in making decisions in matters affecting them.

What, then, are the several interests in an organization which actually if not avowedly participate in these decisions about the statement of jobs? In general terms, are they not the following? 1. The management whose interest is obvious since it is responsible for

[1] See articles by Robert F. Hoxie, "Why Labor is Opposed to Scientific Management," Quarterly Journal of Economics, November, 1916, and Robert G. Valentine, "The Human Element in Production," American Journal of Sociology, January, 1917.

administration and output. 2. The employees as a whole, who have a vital interest, since no job can be defined without taking from or adding to the responsibilities of some other positions in the organization. 3. The workers at the particular process, who inevitably have a great interest in its correct statement. 4. Whatever agency has conducted the actual scientific research and drawn up the tentative job analysis. (Where a factory organization has undergone a logical development, such analysis would be the special research function of the personnel department.) [1]

It is not denied that other factors might conceivably enter into the determination of work, but practically these four groups are the indispensable parties to the final agreement as to what any particular job actually is. In short, the management, the employees as a whole, the workers at the task in question, and the research division are the first court in work decision. They constitute a Determining Board to determine every job.

It is unnecessary in a preliminary study like the present to do more than suggest the relation which this shop organization might have to existing organizations of workers by crafts or industries. It would naturally follow, however, that if there were a craft union of workers at a certain job, this union might be called in to represent the workers, either in a mediatory capacity or to be one party to arbitration proceedings in which the third and outside participant would be a representative of the consumers, or public. In those extreme cases where differences proved incapable of immediate amicable settlement, the union would be the natural

[1] This reference to the research division as well as the subsequent mention of the employment division, assumes the existence of a Personnel Department in an industrial organization. The purpose of this staff department is to handle all matters that affect the workers. A competent department would include (1) the employment division, (2) the training division, (3) the research division.

organization to conduct a strike. In the same way, an industrial union representing all the workers of an industry might be called into action where disagreements assumed an industry-wide character. The ultimate necessity for this outside affiliation has already been met by a similar wider affiliation among employers not only by industries but between industries. As issues become more extensive there would be a representative body of all workers and of all employers in an industry, as well as the public's delegates, to settle the most momentous disagreements. It needs hardly to be pointed out that this alignment makes an actual resort to strikes far less likely, because their reason for being is so largely removed.

The important point is to have justified the logic and validity of the internal Determining Board, with its opportunity for outside appeal if that becomes necessary in order to protect the rights of any of the parties.

Assuming now that the Determining Board is established, what are its functions? At any particular job there is a certain length of the work day, within which it is more or less definitely ascertainable that a person can work at a certain general rate of speed (varying from hour to hour and day to day and to some extent from season to season, but still running through the year at a fairly level average) without any question of physical or mental deterioration arising. Within this healthy working day, whatever it may be, it is obvious that slovenly, slipshod or slow work on the part of the worker who could work faster without exceeding the limits of physical and mental health, is against the interest of the employee from the point of view of both his own skill and self-respect, to say nothing of the ultimate lessening of his earnings due to low production. From the point of view of his costs such poor work is against the

interests of the manufacturer. From the point of view of the character of the individual and of the economic cost of the product, it is against the interests of society. It is very decidedly to the advantage of everybody — worker, employer, consumer — that once the length of the work day and a safe speed of work are agreed upon, each should see to it that a full day's work is done. Upon this point a substantial identity of interest exists.

If the time comes when a reduction of hours is demanded below this agreed length of work day, then indeed opposing interests come into play — of the workers, of the management, and of society. To adjust this conflict of interests will require one of the three available methods — conciliation, arbitration (i. e., adjudication by a third party) or the use of the strike. But for the near future this is not the critical problem. Our anxiety is not yet over workers who may be declaring for a seven-hour day. The great majority of nine, ten, and eleven hour a day toilers demand profound and immediate concern.

The point of contention, owing to meager knowledge and inadequate scientific technique, is as to what *is* a reasonable length of work day and safe intensity of work. The determination will depend upon almost infinite variables between factory and factory and industry and industry, as well as between worker and worker. In many cases a combination of studies of past production records and time studies will eventually give the standards of an operation in point of required time and safe speed. As modifying these there must be intensive study of the influence on the job of accident and fire risks, of ventilation, heating, humidity, cleanliness, lighting, toilet and drinking water facilities, noise and vibration. One of the vitally important points in the four-fold representation for agreeing to the details

of a job is that in this way alone will these and other variables receive proper weight and recognition. But altho each party to the transaction is keenly alive to protect his own interests, this is far from involving a hopeless conflict. The findings of the research division as to the facts about a job afford a definite starting point. To the extent that exact knowledge is at hand, possible disagreement is reduced. Even so, the field where judgment and opinion obtain will still be large. It will remain for the Determining Board out of the many-sided experience of its members to give weight to the variables in such a way as to insure that the final statement of a piece of work is as honest a one as human intelligence can secure.

II. How Much Pay?

If we can now assume a knowledge of the fair average expectation of work from workers of varying degrees of skill, and assume that this work is agreed to by all parties and is performed, the question arises as to the basis upon which it shall be paid for. This involves a consideration of the factors which will throw light upon the financial affairs of the industry and individual plant.

We have first to survey the field of present practice and tendency in analysis of the factors recognized. What is the basis upon which the several claimants for a share of the gross income divide that income and should divide it?

There have in the last few years, been any number of so-called "advanced methods" of pay which aim at securing closer relation between efficiency and reward. The fundamental difficulty with them all is that the basis of each has been the "going rate of wages." To admit, as they do, that base rates equal "standard

rates in the district" or are some percentage more than such rates, is to throw away the case so far as any claim to scientific division of earnings goes. If the problem is to be faced through from the beginning, there must be consideration not only of present payment practices in industry but of the meaning and uses of an American standard of living.

It is admittedly confusing to try to deal with payment plans because of necessity present practice and possible future practice will have to be considered not as two distinct systems, but as one gradually being modified into another. It is our assumption in this discussion that the tendency toward larger, non-competing[1] producing units is desirable and that both state and nation will be required to increase control and regulation. If there is ultimately to be in business at large any such oversight as now prevails in the public utilities at the hands of the various public service commissions, we are in sight of more intelligent arrangements in which at the very least the cards of the owners and users of capital are on the table. The importance of this in the division of earnings will next be considered.

If we approach the problem from the angle of present practice, we must consider at once who assumes the risk in industrial operation. This must be considered because in stating the cost of production the extent of risk is in the last analysis the point which occasions greatest controversy.

Do the owners and borrowers of capital assume all the risk? Profits accrue to them today because it is conceived that they are the initiators, responsible agents, and, if necessary, the losers in industrial development. That this is true as a general proposition seems plausible.

[1] I. e., "non-competing" in the sense that they are not competing for *markets*.

And in certain fields, particularly in marketing new commodities, there *is* a risk that none but relatively few in the community are willing to assume; and the extension of industrial activities is at present wholly dependent upon their assuming it. But these cases can fairly be left out of consideration because of their relatively small number in proportion to the total production. Setting aside these exceptions, and viewing the problem as industry exists today — not as it has been developed but as it stands today — the extent to which investors and enterprisers in industry assume risk is a matter as to which each case must be considered separately. The risk is one thing in a highly competitive business where the demand is new and destined to rise; it is another in a monopoly; it is still another in a declining business doomed to disappear.

Moreover, the risk that the employees assume is by no means inconsiderable and is consistently ignored in most discussions of the subject. It frequently happens today that the capital owners or enterprisers have "more than one iron in the fire" and "their eggs are not all in one basket." Furthermore, the owners are in a position to wait for their returns. And, finally, they definitely plan to compensate themselves for bad years by the reserves and surpluses of good years. Not so the workers. Their eggs *are* all in one basket. They cannot wait long for their returns. They have little or nothing to tide them through bad years. They are expected to come for work where work is offered; work for little more than subsistence rates while it is offered; and get out when it is finished. Theirs is the greater risk in the sense that they put all their strength — their working capital — at the disposal of a given enterprise. Its success or failure is their livelihood or unemployment.

There appear, therefore, to be really two kinds of risk distinguishable by their consequences. To the capital provider the risk is a property one — usually a matter of only part of his holdings. To the manual worker it is a human one — a matter of personal and family sustenance.

It would probably be true that the extent of the capitalist's risk would depend in part upon the proportion of his total capital that was committed to one venture. And altho no technique has yet been developed for accurately establishing the extent of risk which he assumes, that does not mean that it is impossible. There have not yet been publicly available the data necessary to begin to formulate a method. Up to the present the best we have been able to do as consumers is to try to protect ourselves by a variety of means from claims for excessive risk-earnings. These means include, for example, publicity of certain corporation accounts, the taxation of unearned increments, of incomes, special privileges, franchises, royalties and patent rights.

The workers as distinct from the consumers will have to protect themselves by some other means such as we shall presently outline.

Leaving, for the moment, the question of the cost of risk, let us proceed to a summary of the other elements in production costs, since this offers the readiest method of arriving at a knowledge of the amount available for wage and salary earnings. The next point that arises — as to whether interest and dividends on capital shall be a cost charge or not — is one that is still a much mooted question in the accounting world. At least a part of the occasion for debate is that those who are getting high profits on the pretext of the great risk involved know that in many instances a careful analysis of their busi-

ness would justify the disbursement of earnings little if any above the current interest rate for that industry. In these instances, if the interest charge computed at the current rate for the industry were made one of the costs of the business, instead of being left as now a variable amount contingent upon the concern's profits, the surplus would be so large as to occasion a protest from consumers on the score of the high cost of the commodity and from the workers on the score of low wages. If, therefore, we are ever to get the conditions of a business clearly before us, the interest charges should be definitely limited, or be on an agreed sliding scale. This item should then constitute part of the cost. This means, of course, that so much of interest as is supposed to be a payment for risk will no longer figure as a part of interest, but will be treated separately on its merits, either as another item of cost or as one of the items to be met in the division of that residuum which we are about to arrive at.

The changes made for depreciation and for reserves may at any time become the subject of controversy. For these items also it is impossible to generalize as to what would be a fair allowance. But as long as amounts thus written off are publicly known the possibility of abuse is reduced.

The cost of raw materials is, so far as we are here concerned, a fixed item; as is also the charge for patent rights. A further cost, the importance of which is now being understood, is that necessary to keep working conditions up to a high human standard. This should include provision of the best contrivances in matters of sanitation, ventilation, prevention of fire, sickness and accident.

Finally, a knowledge of the selling price of the goods produced will enable us to find the amount which is left

to pay for the services of managers and manual workers and possible additional pay to the risk takers. The selling price depends, of course, upon many conditions. But in general, we know that the price at which an article will be sold is governed by the expectation of a certain demand for a certain amount of product. And in a well-established market the amount that can be sold and the prices at which it is possible to offer goods are both greatly limited.

We can, then, as a general proposition come to this conclusion: the amount left after deducting the above costs from gross income will give the amount that is left for division among the active agents, head and hand workers, in a business.

All this will, of course, seem a completely backhanded way of going at the problem to those familiar with the thesis that labor is to be bought in the cheapest market and that wages are one of the principal costs which the risk takers, as initiators of enterprise, must meet. Our procedure has completely reversed prevailing practice. But any consideration of the problem that is going to face every factor frankly, and most important of all, is going to give workers confidence in the rates that are set and consumers confidence in existing prices, will have to result in some such attitude toward the costs of production. For it is at this point, the discrepancy between the earnings of workers and owners, that the prevalent unrest is most acutely occasioned.

There is a growing tendency to consider the division of earnings on this ultimate basis. It does not mean that tomorrow any business can say definitely what its residuum is and sit down to haggle with employees over its distribution. But certain definite steps toward a more equitable arrangement can be at once taken by any company. It is clear that actual payments to workers

cannot be made only once a year, after the results of the year's business have become known. Weekly drawing accounts must be settled upon, and how the amounts of these can be arrived at is the next question. If at the end of a year there is still a net surplus after all these charges have been met, we have an amount which can be apportioned between workers and risk takers on a basis which will also have to be agreed upon.

How, then, to settle the amount due the president, the office boy, and the truck hand? Clearly the first duty will be to establish a minimum rate below which no worker will be paid. And this minimum must be set on a flexible scale in the light of a thoroly contemporary knowledge of a wholesome standard of living in the locality — a standard that includes all the elements that make for a progressive citizenship. In order to standardize throughout industry an approximately equal minimum basis, it is increasingly recognized that certain operating standards must be upheld by legislation. These standards seem destined to include a minimum wage, safe and wholesome working conditions, accident, sickness, and unemployment compensation, and, if necessary, a pension during old age.

If we can next get some notion of maximum salary, we are then left to the most trying problem — settling the amounts of earnings between the extremes. For some time to come it would seem that the law of supply and demand working to adjust earnings in the field of executive and administrative positions would not lead us very far astray. Able administrators are rare. Their value is appreciated more and more throughout the industrial hierarchy. Business owners and workers as well are showing themselves willing to pay what they must to get the right type of leadership. Moreover, the effect of publicity and the increasing influence of the

wage workers in these matters will be an invaluable corrective force.

As to the work of manual laborers themselves, present practices checked by thoro job analysis will give some rough indication of the relative value of the several tasks in a factory. Beyond that it would seem that the finer adjustments are subject to the indefinite pulling and hauling of several forces in an effort to establish a momentary equilibrium. A sense of humor must keep us from feeling any ultimate certainty or security in fixing one man's worth as so much and another's at a few cents more. This cannot be done on any absolute basis. But we can do the next best thing. We can get the interested parties together and let them thrash matters out with the financial and technical facts fully before them.

The same argument, therefore, seems to hold here that was advanced in the case of job determination. The several forces at interest in any decision must be represented in making it. There the matter to settle was the amount and quality of work; here it is the amount of pay for that work. The representative body that settles this question is called the Wage Board. It represents the managing interests, the workers as a whole, the workers at the particular operation, and the financial or capital owning interests, as distinct from those of management.

Whether the rate set be a week rate or a piece rate or some combination is a secondary point. Any of these may offer sufficient incentive and adequate yearly earnings. With certain kinds of work a piece rate carefully set can be an equitable method of payment. To insure this, both worker and employer must be specifically protected — the worker from rates set too low, the employer from a sporadic and irregular output which

may result when piece work is done at the employee's convenience. The worker must secure a piece rate sufficient to offer an adequate weekly wage if a reasonable speed is attained. The employer is justified in demanding that finished work be forthcoming with a regularity known in advance sufficiently to enable work to be routed through the factory in a systematic fashion and delivered promptly as ordered. This end would be secured if amounts of output were jointly agreed to.

If the job analysis be properly made, so that the achievement of the worker week in and week out can be checked against a fair expectation, weekly wage payment probably offers the most generally satisfactory method of pay, when everything is taken into account. This does not mean that every worker is paid the same. On the contrary, since the Determining Board has already furnished certain indications as to the relative capacity of the slow, medium and exceptional worker, the Wage Board has at hand a useful gauge in helping it to decide what different weekly earnings it will give for different amounts of output at each job.

The important point is, and this corresponds with the most successful prevailing practice, that the unit of time taken to judge the worker's achievement and capacity must be a relatively long unit, which admits of a recognized fluctuation in a person's work from hour to hour and day to day. If the work of an employee is averaged over a given period from adequate production records, there can be little dispute whether he had over that period turned out an amount of output agreed to as reasonable for those of a certain degree of skill.

All this reënforces our point as to the necessity of the workers' participation in settling what will constitute fair rates. It may be urged that were the rate fairly

set, no need for the worker's voice in the matter would arise. But what is "fair" is precisely the question in dispute. Moreover, in the long run no one can be relied upon to have perpetual concern for anybody's interest but the person himself. There is nothing invidious about this. It is a fact. And it is decidedly characteristic of the best human nature that we know. It simply means that no one dares, or should dare, to speak finally for another in matters closely relating to that other's well-being. The "fairness" of wage divisions is dependent upon all interests receiving equal consideration.

The participation of the workers as a whole in the decision as to rates and amounts of earnings is the final safeguarding provision, since under fair conditions no one is in better position to judge of a man's attitude toward his work and his success at it than those among whom he works. The amount that goes to one group of workers will also limit by so much the amount available for the others. There are therefore in several directions checks and balances upon the process of distributing earnings.

It is interesting to consider that in addition to giving adequate recognition to the worker's claim for a voice in dividing earnings, this method offers the only real protection to the business administrator. By the presence of representatives of other interests than those responsible for immediate output, he is almost automatically prevented from trying to gain a short time advantage in these matters, as against the really more valuable long time advantage which a policy of human conservation would afford.

To return now to the question of payment for risk, it is seen to be a difficult one from the point of view here established. But that a more representative control in

industry would mean an ignoring of the risk element is unlikely. It cannot be ignored. But it still remains to decide who will be asked or allowed to assume industrial risks. This must be the subject of another discussion. We can be sure, however, that under more widely distributed control the reward to risk takers will tend to approximate more nearly the risks which the facts of a given industry show that the enterprisers assume. For some time to come, of course, the distribution of net surplus will remain with boards of directors representing predominantly the capital owners. But how much surplus will be accumulated, and whether it will be used for extra dividends or stock dividends, is a matter of vital importance not only to the owners but to the workers and consumers. And these groups are destined to take a hand in influencing the results if any fairer distribution is to take place.

The advantages of the method here proposed for dividing the net earnings of a business may be summed up as follows:

It automatically gives the workers and the public the protection which comes from knowledge of expenses, of gross earnings, and of the residuum.

It tends to make individual earnings more nearly correspond to the worker's interest and effort.

It makes participation in the control of industry not simply a "right" but an arduous responsibility of workers and consumers.

It protects the employer from the temptation to false economy in low labor costs.

It tends to give to owners of capital only as much as it is necessary to pay to get capital; since it states separately the costs of managerial ability, risk and capital *per se*.

All this proposes to introduce into the financial aspects of the discussion many considerations which are not current practice in any but public service corporations — some not even existent there. In public utilities the community has come to see the logic of publicity and limited dividends, in order that it be in a position to decide the merits of increases in capitalization, changes in rates, the justice and expediency of wage demands and the like. In exactly the same way, as the problem of the division of earnings in what we today call private industry goes before wider tribunals these relevant facts must be forthcoming. And they stand increasingly to be forthcoming on the assumption above made, that those who do the work are to participate in the residuum which is left after the other more or less fixed charges upon industry are met.

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THE GERMAN STEEL SYNDICATE

SUMMARY

Introductory, 257. — I. The first period, 1904–07, 260. — Efforts to increase control, 260. — The open hearth works, 261. — Syndication of B-products, 262. — Agreements with foreign producers, 266. — II. The second period, 1907–12, 267. — Renewal problems, 268. — Works dealers, 270. — Allotments, 271. — Renewal, 272. — Changes and readjustments, 272. — Upper Silesian Syndicate, 274. — Relations with open hearth works, 274. — Combination in B-products, 275. — III. Third period. Extension of the syndicate, 1912–17, 276. — Chief difficulties, 276. — Removal of restrictions on B-products, 277. — The syndicate since 1912, 280. — Attempts to syndicate B-products, 282. — Influence of the war, 284. — IV. The price policy of the steel syndicate, 284. — Domestic prices, comparison, criticism, 284. — Export prices and export bounties, 286. — Relations of the syndicate with buyers, 287. — V. Influence of the steel syndicate upon the industry, 289. — Upon the profitableness of constituent enterprises, 290. — Allotments and sales, 290. — Growth of integration, 291. — Over-expansion, 291. — Conflict between integrated and non-integrated works, 293. — VI. The steel syndicate and middlemen, 299. — Organization of dealers under syndicate control, 300. — Advantages and disadvantages to dealers, 300. — VII. Conclusion, 303.

THE union of the leading German steel manufacturers in the steel syndicate in the year 1904 brought into existence the most comprehensive combination in the German iron industry and, next to the coal syndicate, the most powerful of all German cartells. Its organization was of the advanced cartell type, providing adequate machinery for the purposes of the combination, chief among which were limitation of production and control of price.[1] The steel works owners became

[1] The organization of the steel syndicate and its operation to the end of 1905 are fully treated in an excellent article by Dr. Francis A. Walker published in this Journal, May, 1906, pp 353–398, to which the reader is referred. In addition to the sources there cited may be mentioned the subsequently issued Denkschrift ueber das Kartell-

members of the Association of Steel Works Owners and at the same time stockholders of the steel syndicate, which constituted the sales and administrative agency of the combination. With this limited liability company they were bound as producers by contracts which obligated them to sell certain types of steel products exclusively to the syndicate in specified amounts for a period of three years. The syndicate sales agency dealt only with the so-called A-products, including railroad and structural steel, and heavy-steel manufactures such as ingots, blooms, billets, and sheet plates. The large group of more highly finished articles, such as bars, wire rods, sheets and plates, called B-products in the syndicate contract, were merely limited as to volume of production; they were not handled by the syndicate.

It was the hope and ambition of organizers so to extend the scope and power of the steel syndicate as to include B-products. How far actual developments have diverged from original aspirations will appear in the course of the present study. The internal history of the syndicate is largely concerned with the efforts made to maintain and increase its control in this direction and in others.

I. The First Period, 1904–07

As organized in 1904, the steel syndicate was not regarded as complete with respect to control or perfect as regards organization. In three directions lay possibilities of increasing the market control of the combination: first, in an increase of its domestic control over A-products, 90 per cent of the production and sale of

wesen, Teil I, 1905, (Drucksachen des deutschen Reichstages, 11 Legislatur-periode, II Session, 1905–06, Nummer 4); hereafter cited as Denkschrift. Cf. also the Report of the Federal Trade Commission on Coöperation in American Export Trade, 1916, Pt. I, pp. 214 et seq.; Pt. II, pp. 3–19.

which it governed as early as the beginning of 1905;[1] secondly, in an extension of its power to lighter steel, the so-called B-products; and lastly, in the protection of the domestic market from foreign interference.

(1) The manufacture of the remaining 10 per cent of A-products was divided among several large concerns: one in Westphalia and the others in Upper Silesia, and a number of the smaller open hearth works located chiefly in the Siegerland iron region. The Westphalian Steel Works Company could not be induced to enter the syndicate during the period of its first contract; but with the Upper Silesian concerns the combination was more successful. After protracted negotiations resulting in the formation of the Upper Silesian Steel Works Union dealing with lighter steel, so organized as to coöperate with the syndicate in heavy products, those Upper Silesian firms which had not joined at the outset finally entered the syndicate in 1905.[2]

The open hearth works controlled but a small proportion of the total steel production and most of this was ordinarily manufactured into B-products which enjoyed a well-defined market preference. Accustomed to disposing of their entire output upon the domestic market, they were averse to joining a combination in which they would be compelled to share the costs of fostering the export trade by means of bounties to be paid to their exporting competitors. There were advantages in remaining outside. Production could be increased without restraint when the market seemed favorable. They saved the expense of cartell membership. They believed that the steel syndicate could not afford to break the market for heavy steel by price cutting merely

[1] Berliner Jahrbücher, 1905, p. 105.

[2] For details cf. Kontradiktorische Verhandlungen, vol. iv, pp. 278, 475 et seq.; Denkschrift, pp. 14, 50, 316; Kartell Rundschau, 1904, pp. 450, 532; 1905, pp. 372 et seq., 428, 490; Quarterly Journal of Economics, vol. xx, p. 375.

in order to silence the competition of producers of so small a fraction of the total.

The steel syndicate endeavored to persuade, then to coerce the open hearth works, by increasing the prices of raw material through readjustment of freight bases, into joining the cartell; but to no avail.[1] Negotiations were resumed after an unsuccessful attempt to syndicate bars in 1905, but were likewise fruitless, altho seconded by the coal syndicate at this time. The open hearth works were the best customers of the coal and pig iron syndicates. Members of the steel syndicate themselves almost without exception bought no coal and pig iron; they produced their own, and hence had also become influential members of the coal and pig iron combinations.[2] As members of the latter cartells they wished to retain the open hearth concerns as customers; yet as members of the steel syndicate, they found the competition of these concerns at least potentially annoying. Efforts to bring the latter into line were finally abandoned; their entrance into the syndicate was of small importance when consideration of the extension of the steel syndicate itself was taken up in 1906–07.

(2) The control of B-products would have added immensely to the power and comprehensiveness of the steel syndicate. At the outset it was firmly intended to bring about their inclusion as soon as possible, and the restriction imposed upon their production by the syndicate agreement of 1904 was regarded as a first step toward the goal. As the then existing combinations controlling particular classes of B-products expired, they were to be absorbed one by one, until lighter steel should be as firmly controlled as A-products. The steel syndicate was in no position to take action until its

[1] Kartell Rundschau, 1904, pp. 449, 750; Berliner Jahrbücher, 1905, p. 115.

[2] Kartell Rundschau, 1905, pp. 106, 194, 492.

members had designated their intended group division of the total B-allotment, which was to be declared in the fall of 1904. By that time the outlook for the successful consummation of plans to syndicate B-products had grown considerably darker; in fact, even the continuance of the existing specialized combinations [1] had become doubtful. The steel syndicate therefore postponed the attempt to control these products, and directed its energies to the retention and expansion of the threatened existing cartells of sheet, wire rod, and tube manufacturers, and the formation of other cartells for the branches not already organized. In order to be effective, such combinations must include the large integrated members of the steel syndicate itself as well as the independent rolling mills. The steel syndicate, as the chief source of the raw material used by the latter, desired that its customers should be in a position to shift any advance in the price of raw materials and to maintain them at a profitable level; since thereby complaints as to the prices of half-finished products would be eliminated and the ultimate inclusion of B-products facilitated by satisfactory combination experience on the part of the independent mills.

The coöperation of the members of the steel syndicate was thus essential to the success of any combination of the producers of B-products; for with the lower costs of production of the great integrated concerns, they could by their competition wreck any cartell of independent producers. Given the entire willingness of its own members to join a proposed cartell for B-products, the steel syndicate could exert pressure upon independent concerns to join, by controlling the output and prices of

[1] For all the particular groups of B-products except steel bars there existed at the time of the organization of the steel syndicate, special cartells many members of which became members also of the larger combination. These were, specifically, the light sheet, the heavy sheet, the wire rod, the gas pipe and the boiler tube cartells.

A-products, especially of half-finished products used by the independent rolling mills, to the disadvantage of the recalcitrant firms. Cutting off supplies was indeed not ordinarily effective, and merely gave an opening to the open hearth works. But the syndicate might grant concessions in prices and terms to those firms which acquiesced in its wishes. The usual form of concession was the grant of the so-called export bounties.[1] Beginning in 1905, bounties were consistently granted for the encouragement of the export trade to those manufacturers only (otherwise qualified) who were organized in cartells to which the bounties were paid for subsequent distribution among members. And later in the same year, the strictness of the provisions relating to bounties was further increased by the requirement that both domestic and export trade must be under cartell control to entitle the combinations to the export bonification.[2] The wire rod, the gas pipe and boiler tube, the wire nail and the sheet combinations thus qualified; but the grant to the wire rod and the wire nail associations was made conditional upon their extension beyond April, 1906. An exception was made in the case of bars; it was considered impossible to form a syndicate, and bounties were nevertheless granted.[3] The extension of the wire rod combination and the formation of the Black Sheet Association are to be ascribed chiefly to syndicate policy with regard to export bounties.

On the other hand, the coöperation of the integrated concerns was not to be taken for granted. Membership in B-products cartells might to a certain extent be beneficial if price maintenance were carried out and economies secured in distribution. But it was at least open to question whether or not the limitations to which

[1] Cf. infra, p. 286.

[2] Kartell Rundschau, 1905, pp. 145, 692.

[3] Ibid., p. 692; 1906, p. 204.

they would be compelled to submit as members of a cartell would not entail a sacrifice outweighing the benefits. Maintenance of output at a fairly uniform volume was essential to the greatest efficiency of production. If A-products were syndicated a decrease in the demand for these could only be compensated for by increasing the production and sale, perhaps at low prices, of B-products, which quantitatively were not so rigidly restricted. B-products formed a sort of buffer between the fluctuations in the demand for A-products and the disposition of a constant total output. The peculiar fitness of steel bars to perform this function of an outlet, or "Sicherheitsventil" accounts for much of the difficulty experienced in the efforts to bring them under syndicate control.[1]

The first period of the existence of the steel syndicate seems to have been one of disintegration of B-products combinations. It was found impossible to cartell bar producers. Several of the existing combinations were dissolved during the three years. The light sheet association expired and only a shadow of the former organization took its place as the result of the efforts of the steel combination.[2] The heavy sheet cartell was likewise not reorganized or renewed upon expiration. Only ship-

[1] Control of the production of steel bars would have added more to the power of the steel syndicate than the control of any other class of B-products. They constituted the chief B-production of syndicate members, amounting to 70 per cent of the total for the Empire (1.5 million tons), the balance being turned out by the independent rolling mills, about twenty in number, and by some sixteen open hearth concerns. Unlike the other B-products, the steel bar branch possessed no cartell in 1904, in spite of the numerous attempts made in previous years. Efforts were resumed after the organization of the steel syndicate, but the difficulty of forming a firmly organized syndicate caused leaders to turn their attention to loose price agreements. Several of these were made, but the level of prices maintained was not high enough to remove dissatisfaction. Endeavors were abandoned late in 1905 and were not resumed until over a year later in connection with the renewal of the syndicate. Kartell Rundschau, 1904, pp. 800, 492; 1905, pp. 115, 367, 490; Berliner Jahrbücher, 1905, p. 115.

[2] The distinction between light and heavy sheets controlled by the two sheet combinations was an arbitrary one; the division was made at a thickness of 5 mm., all above being classed as heavy.

building material was placed under syndicate control; a result not due to the steel syndicate but to nationalistic motives and to preferential railway rates granted by Prussian railways. The wire rod syndicate was with great difficulty extended to the middle of 1907; but the wire nail syndicate closely affiliated with it was definitely dissolved and not even a price agreement took its place. Moreover efforts to syndicate wire had borne no result. The extension of the gas pipe and boiler tube combinations took place prior to the definitive organization of the steel syndicate. In general it was found impossible to carry negotiations forward to a successful conclusion before the middle of 1906. The extension of the steel syndicate then became the center of interest; while consideration of the syndication of B-products was postponed.[1]

The underlying cause for the failure to cartell B-products in the period 1904–07 seems to have been the irreconcilable conflict of interests between the integrated works in the steel syndicate and the independent producers, usually smaller rolling mills not possessing the advantages of integration; both of these interests must be included in any combination aiming to control a group of B-products. Added to this was the influence of the extreme prosperity experienced by the iron industry, 1905–07, which rendered combination of less interest to producers; business was good, prices were high, and all firms were working overtime to execute orders.

(3) The third and last means of increasing market control adopted by the steel syndicate was that of securing immunity from foreign competition through agreements with foreign producers. Precise information, with regard to those arrangements in which the steel

[1] Details on the history of the various subsidiary syndicates for B-products are to be found in the general sources cited for this paper. To follow them here would unduly cumber the discussion.

producers of the United States are presumed to have participated, is much more difficult to secure than that concerning German cartells. However, it is quite certain that an international rail cartell, in the formation of which the German steel syndicate took a leading part, was organized in 1904, and continued to exist for a decade. Austrian, German, English, American and Belgian producers agreed upon limitation of export to various countries and territorial division of the market. Other agreements of the steel syndicate with Belgian and French steel concerns, concerning the division of the market for half-products and for beams, were of less importance.[1]

Surveying the results of the efforts of the steel syndicate to increase its control during the first period of its existence, it must be admitted that they were not attended with startling success. The control in A-products had been slightly increased by the entrance of the Upper Silesian concerns, but neither the Westphalian Steel Works Company nor the open hearth concerns had receded from their positions. Nothing had been accomplished with B-products and conditions were more unfavorable for the speedy inclusion of these than in 1904.

II. The Second Period, 1907–12

The steel syndicate contracts, made in 1904, were to expire in three years from date of organization — so short a period that matters connected with the initial organization had scarcely been settled when the question of renewal came up for consideration. Experience of the members with the operation of the syndicate had

[1] Kartell Rundschau, 1904, p. 401; 1906, p. 160; 1906, p. 693; Stahl und Eisen, 1913, p. 382.

been sufficiently satisfactory to incline them toward extension rather than toward a restoration of unrestrained competition. Prices and profits had been good during the major portion of the period. How much of this was due to syndicate influence is problematical; probably the influence of the *hausse* of 1906–07 was underrated by proponents of the combination.

Nevertheless it was recognized that renewal would be effected only with difficulty and would be dependent upon the satisfactory adjustment of several important matters of controversy. Upon one point only was agreement reached with ease: concerning a change in organization by dropping the Beirat or advisory council, which had been according to the original articles, the most important governing body.[1] Any member or group of members was entitled to name a member of this council for each half million tons of allotment of A-products. There were consequently nine voting members. In addition each member of the cartell could send a representative entitled to take part in the discussions of the council but having no vote. The active interest of members in the transactions of the advisory council brought it about that nearly all the members of the syndicate were represented at its meetings. All demanded power to vote. Thus upon matters which had to be referred to the general meeting of members, there was merely a repetition of the discussion which had been held in advisory council meetings, and usually by the same persons.

More difficult of solution were the problems of readjusting freight bases and accountants' prices.[2] Upon the question of freight bases there was a split between the

[1] Kartell Rundschau, 1906, p. 570; 1907, p. 382.

[2] The accountants' prices (Rechnungspreise) were the minimum prices paid by the syndicate for A-products purchased. The balance remaining from sales at higher prices was distributed periodically after expenses of the organization had been deducted.

Rhenish-Westphalian and the Saar-Siegerland groups of works, the latter claiming that the bases already selected by the syndicate were unduly prejudicial to the interests of the South German steel works.[1] They threatened to withdraw from the combination unless the relation were modified. The accountants' prices seem to have been considerably higher, as compared to cost of production, for railroad material and structural steel than for half-finished products. There was consequently an additional inducement for works to neglect the production of half-products for the market and to increase the production of the other two groups of A-products; a development to be regretted in view of the appreciable shortage of half-products which occurred in 1906 and 1907.

To compromise the differences arising out of the preferential treatment enjoyed by certain members of the steel syndicate under the old agreement was a further task for advocates of extension.[2] As an inducement to enter the combination, the Phoenix firm had in 1904 been conceded the privilege of buying its extra requirements of half-products from the syndicate at special prices. Certain South German firms received special prices for their output by virtue of special contract. As was to be expected, these firms insisted upon the retention of their favorable positions. The sentiment of many members of the steel syndicate was in favor of discontinuing all such special contracts and refusing to enter into new ones.

Far more serious and far more difficult to solve were the problems connected with the relations of certain members of the steel syndicate to mercantile firms.[3]

[1] Kartell Rundschau, 1906, pp. 570, 571.

[2] Ibid., 1907, p. 159.

[3] Ibid., 1906, pp. 367, 368; 1907, p. 298; Iron Age, 1907, p. 1271. Cf. also British Consular Reports for Germany, 1907, no. 3487, p. 66; 1908, no. 4804, p. 90.

The members of the cartell in general had become more or less dependent upon the organization for the distribution of their output of heavy steel, but individual works to a large extent had got out of touch with their former clientele. Certain works, fully conscious of this, began to affiliate themselves with mercantile firms as a precaution against the possibility of eventual dissolution of the syndicate. At its formation in 1904, three important steel works had been closely connected with wholesale iron-dealing firms, and indeed had in part developed from these firms.[1] Fearing that the activity of the steel syndicate would tend to limit that of the dealers, these three demanded and received a guarantee from the syndicate that their dealers should be allowed to participate in the business at least to the same extent as before the organization of the combination.[2] But all other dealers in structural steel (the chief line handled by the mercantile firms) had been compelled to enter one or other of the Beam Sales Associations, which were strictly controlled by the syndicate and in which the privileges of dealers, with respect to the size of allotments in particular, were considerably less favorable than those conceded to the works dealers (Werkshändler).

During 1906 several other works proceeded to ally themselves with iron dealers; others followed their example in 1907.[3] Then these concerns demanded for the mercantile firms with which they had become connected the same privileges and concessions which had been granted to the three firms in 1904. From the standpoint of the syndicate there were several objections to

[1] These were the Rochling, de Wendel, and Rombach firms.

[2] Kartell Rundschau, 1907, p. 298.

[3] For a complete list of alliances see ibid., 1907, pp. 300, 385; also Berliner Jahrbücher, 1907, pp. 111, 112.

the grant to more dealers than had been favored already. Such concessions constituted preferential treatment of a certain set of dealers, who received the benefit of lower prices than those fixed by the syndicate for the associations and whose allotments were measured with greater liberality. Further, they were relieved from the control which the steel syndicate could exert over the Beam Sales Associations.[1] General opinion among dealers was naturally against such favoritism to selected firms. And those members of the syndicate not affiliated with mercantile firms felt that they were not as well treated as the others.

Most delicate and difficult of all were the problems connected with the measurement of allotments. Nearly all the members desired larger figures of participation upon extension of the combination. Two classes of concerns, however, were especially insistent in their demands: first, those which felt that at the organization of the cartell they had not received allotments as large as their productive capacity entitled them to; second, those which had entered on schemes of expansion, either by large extensions of plant or by means of amalgamation with firms outside the syndicate, and had thus secured or would secure in the near future a considerably increased productive capacity. A part of this expansion was directly traceable to the influence of the steel syndicate itself. Experience had shown that in order to secure larger allotments cogent reasons must be given. The best of all reasons was afforded by a display of large well-equipped manufacturing capacity.

In addition to the problems of size of allotments there was the difficulty of division between A and B-products. During the period 1904–07 there had been a decided shift in the case of many members from the manufacture

[1] Cf. infra., p. 301.

of heavy A-products to more highly finished B-products. This development rendered the syndicate of less importance to its own members, and gave them at the same time an outlet for surplus production. To reconcile the conflicting demands, some for limitation of B-products, others for the entire removal of restrictions, proved a most trying task.

As is so often the case in cartell negotiations there seemed to prevail a sort of fatalistic hope that the combination would be extended eventually, even tho nothing was accomplished before the last day (in this case April 30, 1907). In the course of the protracted negotiations extending from the middle of 1906, after the plan for provisional renewal had been abandoned, now the one problem, now the other seemed to dominate the situation.[1] The less important differences were taken up first and disposed of; attention was then turned to decisive matters. But the necessary assent to extension was secured only two hours before the time limit had expired.[2] At this time the Westphalian Steel Works Company entered.[3]

As extended, the steel syndicate was essentially the same in form as before.[4] The most conspicuous change in organization, the abolition of the advisory council and the assumption of its powers and duties by the general meeting of members, was more nominal than real. Participation in B-products was henceforth to carry the same voting power as A-products, save in matters affecting price fixation for the latter; the purpose of the

[1] Kartell Rundschau, 1906, pp. 312, 313, 367, 569, 570; 1907, pp. 24, 159, 295 et seq.

[2] Ibid., 1907, p. 382; Berliner Jahrbücher, pp. 109 et seq.; Das Handelsmuseum, 1907, p. 246; Der deutsche Oekonomist, 1907, p. 293; Iron Age, 1907, pp. 1578, 1662, 1880; Board of Trade Journal, July 18, 1907; British Consular Reports for Germany, no. 4084, pp. 88, 91.

[3] Kartell Rundschau, 1907, pp. 297 et seq.

[4] Excerpts from the contract which had not been published are reprinted Passow, Materialien des wirtschaftlichen Studiums, vol. i.; cf. also Kartell Rundschau, 1907, p. 382.

amended provision being clearly to limit the power of B-producers in fixing the prices for half-products, their chief raw material, to the detriment of producers of A-products.

It was found impossible to solve the problem of works-dealers without making sweeping concessions.[1] Each member of the steel syndicate was permitted to name a certain dealer or set of dealers, who were to be entitled to claim from the syndicate a portion of the participation of the particular steel concern, not exceeding 25 per cent of the total quota of structural steel. In order to do this the quantities allotted to the various associations of beam dealers had to be cut down to 60 per cent of their former figure.

The controversy over freight bases was adjusted by agreement that accountants' prices were henceforth to apply to freight on board the nearest station. The special treatment of different groups of A-products was abolished. In order to allow for advantages or disadvantages of location, a schedule of charges to be added or deducted from the accountants' prices was computed for each member.[2]

The gradually changing emphasis of production from A-products to B-products was reflected very clearly in the allotment tables issued after the extension of the syndicate. A number of members had begun to stress the production of B-products to such an extent that their allotment of half-products was considerably decreased; they were using their output of half-products more largely in further manufacture.[3] The decrease in the allotment of half-products was therefore not due to any decrease in production on their part but to the

[1] Berliner Jahrbücher, 1907, p. 115; cf. infra, p. 301.

[2] Kartell Rundschau, 1907, p. 298.

[3] Ibid., 1907, p. 470; allotment tables, pp. 472, 473.

growth of integration within the syndicate. The extent to which this development had progressed was well illustrated by the difficulty experienced by the independent rolling mills in securing sufficient half-products as raw material to keep their plants running in 1906 and 1907.

Study of the total allotments by districts also brings to light some interesting changes. The Rhenish-Westphalian iron district retained the first place in the syndicate, but the difference between it and the Lorraine-Luxemburg district diminished. The increase in B-quotas for the latter region, double that of the former, was significant of the growing integration in the southwestern district.[1]

During the second period of its existence, the steel syndicate was a little more successful in increasing its control than during the first. In A-products the competition of outside (open hearth) works became especially annoying when, as a consequence of the low prices prevailing for B-products in the depression following 1907, they proceeded to market their steel production in the shape of half-products, the price of which was being maintained by the steel syndicate at a profitable level.[2] In some cases competition became so serious that the syndicate silenced it by taking over the production of the competing concerns into its own account. The dissolution of the pig iron syndicates also gave the non-integrated producers, especially the open hearth concerns, a supply of raw material at low prices. The situation at one time in 1909 became so critical that there was serious discussion of dissolving the steel syndicate.[3] With the slight improvement in general conditions which set in, the crisis was averted, and the

[1] Kartell Rundschau, pp. 467 et seq. [2] Ibid., 1909, p. 436.
[3] Ibid., 1909, p. 549; British Consular Reports for Germany, 1909, no. 4325, p. 119.

questions involved soon became merged in the series of problems to be settled prior to extension in 1912.

Efforts to syndicate B-products were resumed after the extension of the steel syndicate in 1907 and continued intermittently throughout the five year period of the second syndicate, but were likewise unsuccessful. The great increases in the allotments of B-products conceded to a number of the large integrated firms rendered the position of the independent rolling mills more insecure than ever; therefore, as was asserted, more inclined to listen to proposals for combination.[1] The need of organization seemed to be emphasized by the drop in B-product prices after 1907. Bar producers finally agreed to a loose price convention lasting from September, 1909, to March, 1911, when secret price cutting led to its discontinuance. Plans for a general sheet cartell were abandoned because of the opposition of certain large concerns while efforts to combine light sheet producers separately had no result. Aided by a heavy demand which favored increased prices, heavy sheet producers secured a price agreement in the fall of 1909 which was extended from time to time. The cartell for shipbuilding steel led a precarious existence but continued to function during the five-year period. The wire rod syndicate, reorganized as the Wire Rolling Mills, A.G., was extended for five years. Banking influence was alleged to be responsible for the renewal for three years of the gas pipe and boiler tube combinations. Nevertheless at their expiration in 1910, the opposition of several important producers, engaged in schemes of expansion, was responsible for failure to extend them again.

International agreements were continued during the second syndicate. The international rail cartell was

[1] Kartell Rundschau, 1907, p. 555; Berliner Jahrbücher, 1907, p. 115.

successful in securing the agreement of Austrian, Hungarian, Russian, and Spanish works, whose competition had become troublesome.[1] Members of the steel syndicate also participated in the international tube cartell dating in definite form from 1908; but the collapse of the German tube and pipe syndicates led to its dissolution in 1910.[2]

Meanwhile the general movement toward increase in the size of the individual concern and toward integration had been gaining momentum. The fever of expansion and concentration within the syndicate was not long checked by the reverse in 1907; in fact, the belief that only a completely integrated concern could weather depression furthered the movement. Among others, the Thyssen and Gelsenkirchen firms announced great plans for expansion. The changes in productive capacity which were bound to follow were accompanied by definite plans to secure largely increased allotments if the steel syndicate should be renewed upon expiration of the existing contracts.

III. Third Period. Extension of the Syndicate, 1912–17

The fundamental objection of the integrated establishments to any combination which would tend to limit their freedom, not allowing them to shift production from one group of products to another, according to market conditions, was much more apparent in 1911 and 1912 than five years earlier. The steel works owners

[1] British Consular Reports for Germany, no. 4084, p. 168; Kartell Rundschau, 1907, pp. 512, 747, 821; 1909, p. 371; 1910, p. 168; 1911, pp. 163, 541, 919; 1912, p. 693; Iron Age, 1907, pp. 156, 1477; Stahl und Eisen, 1913, p. 382.

[2] Kartell Rundschau, 1908, pp. 573, 689; 1910, p. 598; 1912, p. 695. On the international beam cartell, cf. ibid., 1913, pp. 711, 867. Some information upon the half-products agreement between German, French, and Belgian producers is given in Kartell Rundschau, 1908, p. 1078.

were now divided upon the desirability of syndicating both A and B-products, some holding that both should be fully controlled, others insisting upon retention of the *status quo*. But by far the larger group advocated the entire removal of all restrictions upon B-products.[1] Individual works had become so powerful and were so rapidly increasing their productive capacity that they had little interest in the extension of the steel syndicate unless the figures of participation conceded to them were extremely liberal. With the constant decline in the relative importance of A-products marketed, the syndicate had lost a great deal of its former significance for its members.[2] The absolute amount of half-products handled by the syndicate had decreased in part as a consequence of the amalgamation of independent rolling mills — the most extensive buyers — with producers; in part as an accompaniment of the general increase of integration.[3]

Another obstacle to extension was the demand of a large southwestern firm that it be allowed to retain its monopoly of the manufacture of a certain type of broad-flanged beams manufactured by a special process covered by the so-called Grey patents. Certain other concerns obstinately opposed its continuance.[4]

A third difficulty arose out of the unwillingness of the East and South German works, which produced few half-products or none, to participate in the losses due to a declining market or to forced export.[5] The other classes of A-products were the more profitable, as

[1] Berliner Jahrbücher, 1912, p. 123.

[2] A competent estimate placed the amount of one group of B-products, steel bars, sold in 1911 at 3.6 million tons as compared to the syndicate total allotment of 3.4 million tons for rails and structural steel.

[3] Kartell Rundschau, 1912, pp. 155, 293.

[4] Ibid., 1912, pp. 37, 154, 293; Iron and Coal Trades Review (London), vol. lxxxvi, p. 23.

[5] Kartell Rundschau, 1912, p. 293; Berliner Jahrbücher, 1912, p. 141.

accountants' prices were adjusted; but the profits were distributed equally over the whole A-tonnage. These works therefore advocated the formation of a separate cartell for each class of A-products, or at least some arrangement whereby they assumed no responsibility for half-products. The result would have been to cause the works to demand increased participation in railroad material and structural steel and to restrict the production of half-products for market more than ever.

As upon previous occasions, the question of the size of allotments to be assigned to the individual works was the most difficult of all problems connected with extension.[1] The general tendency during the negotiations seems to have been to shift all claims for increased quotas to the B-group, the purpose being to keep the allotment and the output of A-products within such limits that the price maintenance hitherto accomplished by the steel syndicate could be continued; so that in spite of the overproduction of manufacturing equipment during the past few years, profit would be derived from at least a few steel products. Since the actual sales of railroad material and structural steel had never reached the full allotments, increases in allotments conceded to some firms must necessarily be accompanied by decreases in the allotments of others. The older concerns, having for the most part undertaken extensions of plant, could not be expected to surrender any portion of their allotments without a struggle. The race after allotments in B-products promised to endanger the prospects of renewal still more. The enormous increase of capacity can be judged from the fact that the allotment increases asked for amounted to six million tons, or 50 per cent of the total participation of A and B-prod-

[1] Berliner Jahrbücher, 1912, pp. 122 et seq.; Kartell Rundschau, 1912, p. 293.

ucts at that time.[1] The bulk of this proceeded from a few large concerns. The underlying struggle for supremacy among the various iron districts, between the Rhenish-Westphalian and the Lorraine-Luxemburg, was evident throughout the proceedings, but there was no clearcut division because of the interlocking of interests which had taken place.[2]

Aside from agreement on certain minor questions, little had been accomplished before the last few days proceeding the date when the obligation of the members to sell A-products exclusively through the syndicate expired. Opposing demands had seemed irreconcilable. But in the last session, the majority of works adopted an exceedingly compromising tone, apparently from a sincere desire not to be responsible for the dissolution of the combination. One difficulty after another was disposed of; the Thyssen and other firms agreed upon the wide-flanged beam proposition, and differences with the Upper Silesian works were settled. At the last moment the syndicate was extended for another five-year period.[3] But it had not run the gauntlet of opposing desires and interests unscathed. The limitation upon the production of B-products had been abolished. The organization of the cartell remained the same for A-products, but all provisions relating to the other class were henceforth inoperative. After an existence of eight years even the small beginning which had been made in 1904 toward the syndication of B-products was lost.

Why? Simply because within the cartell another movement toward concentration and combination was

[1] Such as Gelsenkirchen, Thyssen, and Burbach concerns.

[2] Kartell Jahrbuch, 1911, p. 26; Kartell Rundschau, 1911, p. 882.

[3] Ibid., 1912, pp. 545 et seq.; Stahl und Eisen, 1912, p. 769; Berliner Jahrbücher, 1912, p. 122; Der deutsche Oekonomist, 1912, p. 337; Das Handelsmuseum, 1912, p. 277; Iron Age, 1912, pp. 1168, 1237; Iron and Coal Trades Review (London), vol. lxxxiv, pp. 653, 698, 814; British Consular Reports for Germany, no. 4939, 1912–13, p. 47.

taking place, a development having a sounder economic basis than any mere agreement or contract between independent steel producers. And it had been learned that the cartell was in one way restrictive of the full development of integration, altho furthering it by way of reaction. If the steel syndicate was a torso [1] as it formerly existed, it was in the future to be even less than that.[2]

In its emasculated form the syndicate has continued to function since its extension in 1912. The war has aggravated some of the difficulties with which it has to contend, and has given an excuse for postponing action on others. Soon after the outbreak of the war, representatives of the coal, pig iron, and steel syndicates held a joint session with representatives of several organizations of buyers, and satisfactory adjustment of terms of delivery and payment under the altered conditions was brought about.[3] The settlement of the wide-flanged beam controversy, giving the one firm especially fitted for their manufacture a practical monopoly of manufacture, has proved to be but temporary. The patents owned by this firm having expired, other firms have installed machinery for their manufacture and demand allotments. The increased use of concrete for construction has resulted in decreased utilization of steel for structural purposes. The propaganda of the syndicate has not been successful enough to avert the loss of business. Consequently demand for increased allotments presents difficulties. One firm proceeded to manufacture wide-flanged beams and sell them outside, a policy which was upheld by the arbitration court assigned to investigate the legality of the action. As a

[1] Walker, in Quarterly Journal of Economics, vol. xx, p. 398.

[2] The situation in Upper Silesia was hardly changed by the extension of the Düsseldorf combination. In October, 1912, the Upper Silesian Steel Works Company was extended for five years with the same membership. Kartell Rundschau, 1912, p. 1038.

[3] Ibid., 1914, p. 726.

result of this situation and the general unsettlement of conditions, caused in part by the difficulties experienced in the renewal of the coal syndicate, one of the largest concerns in the steel syndicate, the Deutsch-Luxemburg concern, gave notice in October, 1915, of its intention to withdraw from the combination upon the first of March in the following year, or two months after the war if not ended by that time.[1]

The removal of all restrictions upon the production of B-products by members of the steel syndicate was decided discouragement to those who still wished to bring them under cartell control, and was not lessened by the subsequent completion of several immense new plants in the Lorraine-Luxemburg region, built chiefly by Rhenish-Westphalian interests. The situation induced alliance of the smaller establishments with the larger integrated concerns, but these arrangements were not considered sufficient. Consolidation and the formation of communities of interest for long terms of years under strict contracts were chosen by many works in preference. The tube business, after the failure of price agreements, became concentrated in the hands of two groups. One was led by the Mannesmann concern, which had become the most important factor in the tube business because of its largely increased capacity and a series of definite contracts with smaller firms to take charge of the marketing of their production.[2] The other comprised the tube manufacturing members of the steel syndicate, which had organized a temporary joint sales agency. Combination of the two groups was actively urged in 1913 and 1914, but with as little success as the attempts to syndicate bars.[3] The syndicate of wire rod

[1] Kartell Rundschau, 1915, pp. 593 et seq.

[2] Ibid., 1913, pp. 31, 288, 470, 559; 1914, pp. 92, 666.

[3] Berliner Jahrbücher, 1913, p. 153; Kartell Jahrbuch, 1911, p. 241; Kartell Rundschau, 1913, pp. 553 et seq.

producers — the only B-product cartell remaining after the extension in 1912 — after being twice provisionally renewed, was finally allowed to expire by limitation at the end of 1914.[1] The large burdens assumed to keep mills closed down and the inability of the cartell to secure sufficient business at profitable prices were the immediate causes.

Recently the proposals made to bring about the uniform syndication of all B-products have been accorded more attention than those having to do only with a single branch.[2] Long term contracts and protective agreements with the steel syndicate seem to be essential features of the recent schemes. Altho active efforts in this direction were dropped at the opening of the war, the rapidly decreasing margin between the prices of B-products and raw materials caused a revival of agitation, and pending its outcome, led to the formation of several loose price agreements for steel bars, tubes, wire rods and sheets. Early in 1915 discussion turned to the organization of a general association of crude steel manufacturers as a basis for the combination of B-producers.[3] A proposition was finally developed to the effect that a " Deutsche Stahlbund " should be formed, chiefly for the purpose of bringing about the organization of cartells for other products. Steel products were to be classified much as before, each class to be subjected to fixation of price and limitation of output — the whole to form a uniform comprehensive scheme of syndicating the iron industry. About twenty important firms were actively supporting the plan, but a much larger number have exhibited little enthusiasm for it.

[1] Stahl und Eisen, 1912, pp. 2018, 2104; ibid., 1914, p. 1543; Kartell Rundschau, 1912, pp. 919, 1038; 1913, pp. 30, 564; 1914, pp. 291, 373, 668, 727.

[2] Ibid., 1914, pp. 600 et seq.

[3] Ibid., 1915, pp. 114 et seq., 276 et seq.

Reviewing now the first decade of the operation of the steel syndicate, it becomes evident that its significance for the German iron industry had, contrary to the

GERMAN IRON AND STEEL PRICES, QUARTERLY, 1904–15.
(In marks per ton)

Year	Quarter	Blast furnace coke	Brown minette iron ore	Foundry pig iron no. 1	Steel billets	Steel beams	Steel bars
1904	I	..	..	..	..	..	..
	II	15.00	3.00	66.00	90.00	105.00	112.50
	III	15.00	3.00	66.00	90.00	105.00	110.00
	IV	15.00	3.10	66.00	90.00	105.00	106.50
1905	I	15.00	3.10	66.00	90.00	105.00	108.00
	II	15.00	3.40	66.00	90.00	105.00	108.00
	III	15.00	3.60	66.00	90.00	105.00	108.00
	IV	15.00	3.80	71.00	90.00	105.00	112.00
1906	I	15.00	4.00	78.00	90.00	110.00	120.00
	II	15.50	4.00	78.00	95.00	110.00	122.50
	III	15.50	4.10	78.00	95.00	120.00	134.00
	IV	16.50	4.10	81.00	100.00	120.00	144.75
1907	I	16.50	4.10	81.00	105.00	125.00	147.50
	II	17.50	4.10	..	110.00	125.00	149.00
	III	17.50	3.50	85.00	110.00	125.00	142.50
	IV	17.50	3.00	85.00	110.00	125.00	130.00
1908	I	17.50	3.00	81.00	100.00	115.00	112.50
	II	17.50	3.15	76.00	100.00	115.00	107.50
	III	17.50	3.15	72.00	95.00	115.00	101.25
	IV	17.50	3.40	72.05	95.00	115.00	103.75
1909	I	15.50	3.40	61.50	95.00	110.00	102.50
	II	15.50	3.65	60.00	95.00	110.00	100.50
	III	15.50	3.65	57.00	95.00	110.00	99.00
	IV	14.00	3.90	59.50	95.00	110.00	105.00
1910	I	14.00	3.90	62.00	95.00	110.00	108.50
	II	14.00	3.90	65.00	100.00	110.00	110.00
	III	14.00	3.90	65.00	100.00	110.00	111.00
	IV	15.50	3.90	66.00	100.00	110.00	113.50
1911	I	15.50	3.90	66.00	100.00	110.00	113.50
	II	15.50	3.75	66.00	100.00	110.00	107.50
	III	15.50	3.80	66.00	100.00	110.00	100.50
	IV	15.50	3.90	69.75	100.00	110.00	102.50
1912	I	15.50	..	70.50	100.00	110.00	109.00
	II	16.50	4.25	73.55	100.00	110.00	109.16
	III	16.50	4.38	73.50	105.00	112.50	122.25
	IV	16.50	4.63	77.33	105.00	115.00	124.50
1913	I	16.50	4.87	77.50	105.00	115.00	123.66
	II	17.50	4.80	77.50	105.00	115.00	113.33
	III	17.50	4.40	77.50	100.00	115.00	99.83
	IV	17.50	4.75	77.50	95.00	110.00	97.33
1914	I	..	..	75.50	95.00	..	90.00
	II	..	..	74.50	95.00	..	90.00
	III	..	..	79.50	95.00	..	90.00
	IV	..	..	79.50	102.50	..	110.00
1915	I	..	..	79.50	102.50	..	105–110
	II	..	..	86.50	110.00	..	125.00
	III	..	..	94.00	115.00	..	140.00
	IV	..	..	94.00	115.00	..	..

Statistics of coal and iron prices for 1888–1913, from which the above are taken, may be found in Stahl und Eisen, 1913, p. 232; 1914, p. 264. Prices after 1913 are from Kartell Rundschau, 1915, p. 500.

Billet prices are taken as representative of the prices of half-products. The syndicate has maintained a constant margin between the various shapes and qualities of half-products, billets being ten marks higher than ingots, five marks more than blooms and two and one half less than sheet plates.

Of the above prices, those of coke have been controlled during the period by the coal syndicate, those of pig iron in 1904–08 and since 1911 by the pig iron syndicates, those of steel billets and beams by the steel syndicate.

expectations of its organizers, decreased. The A-products were still handled by the syndicate, but relatively they had lost in importance during the decade, and even absolutely the increase was small. The control of the syndicate over B-products became practically nil; not one of the several combinations existing in 1904 had survived the ten-year period, and no others had taken their places. Only the extraordinary conditions of war made possible the loose price agreements of 1914. And to add the final page to the record of failure, the syndicate, weakened as it was by 1915, faced the possibility of dissolution at the end of the war.

IV. The Price Policy of the Steel Syndicate

The center of interest in the study of any combination is its influence upon the public and upon consumers, exerted ordinarily, when standardized products are dealt with, in the fixation of market prices. The power of the steel syndicate was limited to class A (heavy steel) manufactures; but controlling about 90 per cent of these, it could fix selling prices, with the assistance of the tariff, within fairly narrow limits.

Comparison of the prices of structural steel and of half-products as quoted by the steel syndicate, may be made first, with previous German prices from 1888 to 1904; secondly, with the course of prices of steel products, e. g., steel bars, not controlled by any syndicate; and lastly, with American and English prices after 1904. Such comparisons give ample evidence of the stability of domestic prices under syndicate control. With regard to the level of prices — whether high or low — conclusion is more difficult. There was a widespread impression that syndicate prices were unreasonably

high — higher than they would have been under competitive conditions; a view which was fostered by the broad publicity given to the complaints of half-products users concerning prices of half-products and dumping in foreign countries. It is true that the smaller margin remaining to the independent rolling mills after the steel syndicate had assumed control of raw material prices and low export prices gave some basis for complaint. On the other hand, that syndicate prices were not so high as to be excessively profitable seems to be indicated by the fact that the participation in A-products has increased but slightly during the existence of the syndicate; and the amount of half-products, concerning which most complaint was heard, has decreased. It has been argued that the works found it more profitable to produce non-syndicated products, the prices of which were subject to the full force of market fluctuations. Comparisons with international prices, to all intents and purposes the English prices, are inconclusive. In the absence of exact data which take into account the tonnage sold at each price, one hestitates to make the statement that the steel syndicate has secured more per ton than was obtained by the older combinations or by the works when not in combination. Because of their stability, German prices have at times been higher than prices in other countries; at other times they have been lower. It is certain that the steel syndicate has not abused its power by imposing an extortionate price policy upon the consuming public. It seems to have consistently adhered to its announced policy of pursuing a middle course in price fixation, of not attempting to advance prices in periods of heavy demand except slowly, and of lowering them in periods of depression in the same manner.[1]

[1] See table of prices appended. The English prices used for comparison were taken from the London Iron and Coal Trades Review, price supplement, January 30, 1914; American prices from Iron Age, January, 1914, and the Statistical Abstract.

Turning to prices secured in the export trade, which constituted from a quarter to a half of its sales, one is confronted by the difficulty of obtaining accurate data.[1] Maximum prices must have been at least as low as English prices. There is much evidence that the export prices of the syndicate were usually lower than domestic prices and at times were lower than the world prices with which they were competing.[2] The complaints as to the price policy of the syndicate have involved in almost every case bitter protests against the low prices to foreigners.

Rather than quote export prices upon the home market, the steel syndicate continued the plan of its predecessors of granting bounties to buyers of half-products upon quantities of articles actually manufactured therefrom and exported. The syndicate replaced the Half-Products Union in the Clearing House for Export which, in 1902, had been organized by the coal, pig iron, and half-products cartells in order to facilitate the payment of bounties.[3] The general prosperity beginning in 1905 with the accompanying increase of international iron prices made it possible for the syndicate first to reduce gradually and finally to discontinue export bounties in the third quarter of 1907. The market reverse and vehement protests of buyers caused their resumption in 1908, and their continuance at varying levels (in total, including coal and pig iron bounties, from 5 to 20 marks per ton) until the opening of the war.[4]

[1] The Iron and Coal Trades Review, vol. lxxxvii, 1913, p. 545, prints some price statistics which purport to be export prices for German half-products. They are in every case ten to twenty marks lower than the domestic prices quoted by the steel syndicate.

[2] Kontradiktorische Verhandlungen, vol. iv, pp. 358, 360, 419; Morgenroth, W., Exportpolitik der Kartelle, p. 23. On the export policy of the steel syndicate, cf. also Report of the Federal Trade Commission, Coöperation in the Export Trade, Pt. I, pp. 214 et seq.; Pt. II, pp. 14 et seq.

[3] Diepenhorst, F., Ausfuhrunterstutsungen und Ausfuhrpraemien, p. 33; Kartell Rundschau, 1904, p. 373.

[4] Ibid., 1915, p. 118; 1914, p. 663; 1907, p. 775. Bounties were discontinued at the opening of the war but the protest of buyers caused their resumption at a level of ten marks from October, 1914 to March, 1915.

The volume and vehemence of the complaints of buyers as to the price policy of the steel syndicate seem to have varied inversely as the magnitude of the margin between half-finished products and the more highly finished, not controlled by the syndicate. Since the steel syndicate, in accordance with its avowed policy, has consistently avoided following the fluctuations of the market, the margin has increased or diminished with the prices of B-products.[1] In times of depression the margin remaining to the independent rolling mills buying raw material at syndicate prices has become very small or vanished altogether, while in years of prosperity they have been able to make large profits. The main complaints of half-products users, in reality an expression of the conflict of interests between integrated and non-integrated establishments, were three in number. First, prices of half-products were too high as compared to the very low prices of products rolled therefrom; second, half-products were sold to foreign producers at extremely low prices compared to domestic prices; third, export bounties were insufficient to offset these disadvantages and were granted under oppressive conditions (only to those organized in cartells) and were not paid to indirect users of half-products.[2] Taking the evidence as a whole, it seems that dumping was a fairly common practice of the steel syndicate, altho leaders declared that it occurred only

[1] Complaints concerning the prices of the other groups of A-products have received little publicity. Due to the restriction of dealers' profits and the veto of high resale prices, it is probable that ultimate consumers were but little affected and were perhaps benefited by the cessation of speculation by dealers. Railroad material was sold chiefly to the state railways in large quantities under long time contracts. The syndicate was criticised in 1907 and 1908 when it closed a three-year contract with the Prussian state railways for requirements at prices in line with the high iron and steel prices prevailing in 1906–07 but out of accord with the reverse which had set in before the transaction was completed.

[2] Denkschrift zur Lage der Reinen Walswerke, Anlage 3, Kontradiktorische Verhandlungen, vol. iv, p. 479, gives a typical list of complaints.

in isolated instances.[1] Protests subsided during the prosperity of 1905–07, but the collapse in the latter year and the ensuing low prices for B-products with steady prices for heavy steel caused genuine distress among the independent rolling mills. The slowness of the steel syndicate in lowering prices led to a search for other remedial measures. Agitation was carried on in the Reichstag, enforced by a petition of the Association of Half-Products Users, to abolish the protective tariff upon pig iron, scrap iron, and half-products. Drawbacks were also recommended. The syndicate in its statement to the Reichstag protested against the abolition of the tariff and declared that the combination was not raising but merely stabilizing prices. The controversy was taken up by the press and continued during 1908 with much vigor on both sides, but without any effect upon the tariff situation and with but little concession in prices by the syndicate.[2] Since 1909 there has been a decrease in the volume of complaint, due in part to its apparent futility and in part to the adoption of other remedies, in particular resort to amalgamations and communities of interest with raw material producers.

The general charge against the steel syndicate, running throughout the history of its relations with buyers, is that half-products prices have not been such as to allow finished products manufacturers a reasonably constant return. The costs of conversion into bars

[1] Like its predecessor, the steel syndicate participated in a series of hearings (1905) in which representatives of independent rolling mills dealers and cartells aired their opinions. Proceedings are printed in Kontradiktorische Verhandlungen über die Stahlwerksverbande am 20. und 21. Juni, 1905, im Reichstagsgebäude zu Berlin. Stenographische Bericht, vol. iv, pp. 227 et seq.

[2] For particulars of the agitation in 1908, see Berliner Jahrbücher, 1908, pp. 132 et seq., 163 et seq.; Summary of Eingabe der reinen Werke an den Staatssekretär des Innern betr, Aufhebung des Einfuhrzolles auf Roheisen, Schrott und Halbzeug, and of the syndicate's reply in Kartell Rundschau, 1908, pp. 619 et seq., 909; British Consular Reports for Germany, no. 4325, 1909, pp. 117 et seq.

from blooms have been variously estimated, a conservative figure being about 25 marks per ton.[1] It is evident from a study of price statistics that upon various occasions, and of late almost constantly, bars have been sold at prices which did not cover raw material costs plus costs of conversion to the non-integrated mills — those which were compelled to buy half-products at syndicate prices. But has the steel syndicate been responsible for this? The influence of the steel syndicate in causing among its members an increased production of the B-products which constituted also the output of the complaining buyers was indirectly a factor which tended to bring down B-prices, thus decreasing the margin. The other means by which the syndicate was usually alleged to be responsible for the low margin was that of raising the prices of A-products. But a study of the course of prices seems to warrant the conclusion that domestic prices as maintained by the combination were not unreasonably high, tho as a result of the very stability aimed at, they could not at times avoid being out of line with world prices. The causes for the steadily recurring and deepening periods of adversity affecting the independent rolling mills are not to be sought in the price policy of a cartell, but in more fundamental economic and technical conditions.

V. Influence of the Steel Syndicate upon the Industry

The advantages which commercial enterprises expect to derive from membership in a cartell in return for their sacrifice of independent action are in the last analysis a greater stability and higher level of earnings and profits. The cartell is essentially a device for distributing the

[1] Cf. Kontradiktorische Verhandlungen, vol. iv, pp. 350, 389, 481.

output of its members, only affecting the productive process as a means of more effectively carrying out its policies of distribution.[1] The combination can increase earnings of its constituent only by accomplishing this distribution in a more economical and efficient manner than could be done by the firms themselves. In order to be classed as successful, the combination must not have brought about collateral developments which tend or will eventually tend to nullify whatever desirable results it may accomplish.

It is an extremely difficult matter to prove a statement that the steel syndicate has or has not increased the profitableness of its members. The individual concerns manufacture a variety of products not controlled by the syndicate, the price movement and production of which may neutralize or intensify any influence the syndicate may exert. The dividends paid by the members of the steel syndicate as a rule are higher than those of other firms in the iron industry.[2] But is that due to the fact that they are members of the steel syndicate or to the fact that they are all integrated concerns enjoying the advantages that integration offers? It seems more reasonable to suppose the latter. The price policy of the syndicate appears to have been a moderate one; no huge profits could have been derived from it. The volume of sales has not been greatly increased in the classes of products controlled and disposed of by the combination. Therefore it seems that the large dividends are due rather to the economies of production and

[1] The syndicate contract contained a clause to the effect that simplification and specialization of production should be striven for. As a means of bringing this about, quotas might be exchanged among members. Actually little was done along this line and the partial utilization of equipment continued as before. Cf. Kartell Rundschau, 1910, p. 638.

[2] For details and statistics of earnings see Die Schwereisenindustrie im deutschen Zollgebiet, ihre Entwicklung und ihre Arbeiter. Nach vorgenommenen Erhebungen in 1910, bearbeitet und herausgegeben vom Vorstand des deutschen Metallarbeiterverbandes. Stuttgart, 1912, pp. 97–104, also pp. 132, 140–167; Leisse, p. 111.

the efficient management of the integrated works than to the economies of distribution secured by the syndicate. The formation of the steel syndicate has rendered the employment of several agents for the classes of products controlled by the syndicate unnecessary in the same locality. The cartell has consolidated the agencies in some cities, established new ones in others, carried on a certain amount of propaganda work to encourage the use of steel in construction, and has represented the several works at industrial expositions. But the fact that the syndicate disposed of only a portion of the production of its members, leaving the so-called B-products and other articles to the individual concerns, seems to have rendered at least a part of the saving attributed to the syndicate illusory. Since these works were compelled to maintain a selling organization of their own or to rely upon dealers for the disposal of their products, they did not enjoy the economy of dispensing entirely with sales activity or a sales organization.

It cannot be doubted that general opinion of the public and of iron manufacturers was that the steel syndicate had increased the " Rentabilität " of its members. The press generally expresses this opinion. Stock market quotations before, during, and after renewal negotiations, rise and fall with the favorableness or unfavorableness of prospects for the continuance of the syndicate.[1] And yet — even if the general impression was in accord with fact, if the steel syndicate did increase the profitableness of its members, it was at the same time fostering a development which tended eventually to counteract whatever slight effect it may have had in increased earnings — an artificial stimulation given to the expansion of the iron industry.

The actual amount of sales made by the steel syndicate in A-products shows a very moderate increase

[1] See quotations in Berliner Jahrbücher; also Kartell Rundschau, 1907, p. 462.

during the first decade of its operation, if we consider the increase in total steel production in the Empire from 8.9 in 1904 to 18.9 million tons in 1913.[1] This increase is the resultant of increases in the sales and allotments of structural steel and railroad material and a considerable decrease in half-products.[2] The division of sales between domestic and export gives evidence of the success of the syndicate in exploiting the export trade.[3]

The development of B-allotments presents a striking contrast to that of A-products.[4] The allotment of 1911, the last year before syndicate restrictions were removed, was double that of the first year of the syndicate's existence. This great increase, and the decrease of the allotments of half-products, are the most significant

[1] Stahl und Eisen, 1914, p. 424; Kartell Rundschau, 1913, p. 653.

TOTAL ALLOTMENTS AND TOTAL SALES OF THE STEEL SYNDICATE (A-products)
(In thousands of tons)

Year	Total allotment	Total sales	Percentage of sales
1904–05	4,999	4,995	100.00
1905–06	5,014	5,472	109.13
1906–07	5,847	5,757	98.46
1907–08	6,096	5,427	88.97
1908–09	6,168	4,802	77.85
1909–10	6,183	5,017	81.11
1910–11	6,239	5,338	85.55
1911–12	6,270	5,998	95.66
1912–13	6,383	6,395	100.18

[2] TOTAL ALLOTMENTS UNDER THE STEEL SYNDICATE
(In thousands of tons)

Date	A-products	Half-products	B-products
March 1, 1904	4384.2	1440.5	3088.4
Jan. 1, 1907	6227.4	2019.1	4851.7
May 1, 1907	6054.1	1348.8	5817.5
Jan. 1, 1911	6259.5	1417.9	6176.9
July 1, 1912	6244.2	1327.1	Limitation dropped
July 1, 1913	6395.5	1343.7	

From Kartell Rundschau, 1904, p. 339; 1907, pp. 468 et seq.; 1913, p. 656.

[3] The export business of the syndicate has amounted to about 25 per cent of the total sales of structural steel, about 40 per cent of the railroad material, and in half-products has varied from 18 to 40 per cent of the total.

[4] Statistics of actual sales of B-products are not available, but it is certain that allotments were reached in the period of heavy demand from 1905 to 1907.

features of the development of the syndicate. Both are concomitants of the rapid change in the internal organization of the iron industry brought about by the development of the large integrated establishments. This movement toward integration, conspicuous in all iron districts, was centered in the Rhenish-Westphalian and Lorraine-Luxemburg regions. This seems to be the permanent movement toward concentration in comparison with which the cartell is but a temporary organization, deriving its strength from the enhancement of bargaining power and the influence upon prices which it lends to concerns at a time when they were not willing or not well able to withstand the force of unrestrained competition.

It need not be repeated that the steel industry furnishes the classic example of the advantages of integration. They were fully realized by a number of German concerns and in part by many more. It is of course difficult, if not impossible, to measure accurately the advantage enjoyed by the integrated steel works through a comparison of their costs of production with the costs of non-integrated establishments. The amount varies with each firm and is always more or less conjectural. Estimates vary from six to fifteen marks per ton.[1] The important thing is that they did possess a material advantage, amounting often to over 10 per cent lower costs, especially in heavy products rolled in one heat.

In the history of German combination and integration, the desire of enterprises to control their raw material seems to have been considerably stronger than the desire of producers to utilize their product in the manufacture of more highly finished articles. Integra-

[1] Heymann, H., Die gemischten Werke im deutschen Grosseisengewerbe, pp. 212 et seq.; Denkschrift zur Lage der Halbzeug kaufenden Werke, in Kontradiktorische Verhandlungen, vol. iv, Anlage 3.

tion has usually proceeded downward first, from steel work and blast furnace to the acquisition of coal, coke, and ore supplies. Very rarely has a colliery company engaged in the production of iron and steel.[1] The pressure in the former case was greater. Dependence upon producers for raw materials was much less acceptable than dependence upon the succeeding stage of the productive process for a market, due in no small measure to the fact that coal, coke, and later pig iron have been controlled by cartells. It would be interesting and instructive to trace the development of most of the members of the steel syndicate, e. g., that of the Krupp, Phoenix, and Thyssen concerns; but limitation of space forbids.[2] One must be content with the statement that in the movement all methods have been adopted to make the individual concern larger and more independent; exchange of stock, cash purchase, communities of interest, consolidation, merger, lease, as well as extension of plant and the erection of new plants.[3]

It is to be expected that under any conditions some firms would be ambitious and would desire to engage upon schemes of expansion; but the fact that the largest portion of this expansion has proceeded from members of the steel syndicate suggests that membership in it

[1] The Gelsenkirchen firm furnishes an example of the unusual order of development, from an independent colliery to one of the largest integrated steel concerns.

[2] Upon the more recent developments in concentration see Kartell Rundschau, 1910, p. 637; 1911, pp. 389, 597; 1912, pp. 40, 150, 736; 1913, p. 254. The Berliner Jahrbücher give annual lists of amalgamations and alliances. Historical sketches of the individual concerns may be found in Die Schwereisenindustrie, and in O. Stillich, Eisen und Stahlindustrie.

[3] The existence of family concerns unwilling to lose their identity, and the general public distrust of "Vertrüstung" have undoubtedly impeded the use of consolidation of independent concerns located at successive stages as a method of forming large integrated enterprises. These influences and the economic and technical advantages to be gained by constructing extensions or new plants so located and planned as to give maximum efficiency account for the popularity of the construction and addition of whole new plants as a means of becoming integrated. Consolidation does not *ipso facto* increase the productive capacity of the industry concerned; the addition of new plants and equipment can hardly fail of that result.

may have been a factor. The large dividends of member firms and the prevailing opinion of the influence of the syndicate upon the profitableness of steel enterprises rendered it easy to secure capital. Nevertheless it was in another way, as a sort of reaction, that concentration and expansion have been chiefly affected by the syndicate. One will recall the race for allotments in 1904, the liberal measurement of B-quotas at that time, the large increases in 1907, and the dropping of all restrictions in 1912. The steel syndicate was ordinarily not able to dispose of a sufficient amount of steel to cover allotments, in spite of frequent resort to dumping upon foreign markets; and the allotments themselves represented by no means the full capacity of the works. Every firm wished to operate at full capacity, at maximum efficiency; many wished to extend operations. The strict limitation of the amounts of A-products sold to the syndicate, the advisability of fuller utilization of plant than was afforded by allotments, and the necessity of using the resulting surplus in further manufacture, were direct incentives to engage in the production of other than A-products, or at least to have facilities for their manufacture on hand. An additional inducement was offered by the high prices prevailing for B-products in 1906–07, which seemingly rendered it more profitable to market steel in the form of B-products than through the syndicate in the form of A-products.[1] As long as a firm was a member of the steel syndicate, every demand for increased allotments was sure to meet with the opposition of other members whose allotments would be decreased if such demands were granted. Withdrawal from the combination was not a step to be taken hastily; producers therefore waited until expira-

[1] This statement would probably not hold true for a later period, but at the time the factor was important.

tion before presenting demands, meanwhile making themselves more and more independent of the syndicate, and increasing capacity so as to enforce demands to be made when the time for renewal came.[1]

The rise of certain members of the syndicate to positions of power and comparative independence, based upon efficiency and control of natural resources, has not been without its influence as an example. Other concerns have felt stimulated or compelled to follow, in order to be better prepared to maintain their independent existence. They cannot rely upon the steel syndicate or other cartells for continued protection against restoration of competitive conditions. And the outcome of the movement toward integration and increase in the size of the business unit seems to have been an increase of manufacturing capacity beyond need. Expansion has become over-expansion. The low prevailing prices for B-products for several years preceding the war; the fruitless attempts to bring about combinations of B-products and the opposition of the large integrated works to limitation of production; the closing down of wire rod mills and the participation of the integrated concerns in the cartell which bore this expense; the fact that the quotas in A-products as well as the sales by the syndicate have never reached capacity; and the construction of new plants, not in response to any demand for increased capacity, but, seemingly in order to increase the strategic position of the owners — all are indicative of an excessive increase which is generally acknowledged.

[1] In so far as the distress of the independent rolling mills, brought about by the price relation between half-products and finished manufactures, caused them to combine for their own protection with integrated concerns, or to become integrated in some other way, the steel syndicate may be said to have influenced the movement toward integration. But the moderate prices for half-products maintained during periods of heavy demand allowed a wide margin of profit to the independents, thus for a time discouraging integration.

In no section of Germany do the integrated concerns control the entire production of iron and steel. There still exist numerous enterprises carrying on at only one stage of the productive process, manufacturing a single product or at the most a few classes of products. There are pure colliery companies, blast furnaces, and various types of independent rolling mills. Between these concerns which are not integrated and the concerns which are, conflict has been inevitable. It subsides in times of prosperity only to burst forth with greater fierceness during each succeeding period of depression. There are a number of phases of this conflict; for it is evident that a completely integrated concern has interests which may clash with those of some set of producers at every stage in the productive process. The particular phase which is of greatest interest in a study of the steel syndicate is that between syndicate members as manufacturers of lighter steel (B-products) and the independent rolling mills also manufacturing them but buying raw material from the syndicate. Advocates of the syndicate claimed that its organization would lessen the conflict, but the result seems to have been the contrary. Little was done to modify its price policy so as to aid the independent rolling mills. As certain of the latter allied themselves with integrated concerns, collective resistance became less possible for the remaining. More important in increasing the acuteness of the conflict was the indirect influence of the syndicate in increasing the capacity of its members to turn out the classes of products which constituted the chief output of the independent mills.

What will be the outcome of this struggle for existence upon the part of the independent rolling mills? Rolling mill owners assert that it is not the technical superiority of the integrated concerns which have caused their dis-

tress, but the destructive price policy of the steel syndicate. Further it is alleged that the independent mills possess advantages of their own, in more intensive and painstaking labor, more efficient supervision, and higher quality of product. But one can hardly accept this in its entirety. It is probable that for the finer products, the non-integrated mills may be able to hold out longer than in the manufacture of heavier products, but it seems that it is only a question of time until the competition of rolling mills ceases to be a factor upon the iron market.

Several remedies for the situation have been proposed, all involving combination in some form. One solution, which amounts to an elimination of the problem, is the conversion of the independent rolling mills into actual or virtual integrated concerns, either by fusion with other enterprises, or alliances, or by engaging in the production of their own raw materials. The employment of the community of interest arrangement has become increasingly common during the past few years and seems to be in most cases preliminary to actual merger. This remedy is drastic and often extremely distasteful to independent entrepreneurs and to family enterprises which wish to retain their identity.

Other less radical proposals have been considered from time to time. The proposition that the state furnish funds for the erection of a large modern steel plant for the purpose of supplying the independent rolling mills with raw material, broached in 1904, seems to have been accorded more attention in 1908 and 1909. But it never had much prospect of being carried into execution. Lateral combination, cartells among the rolling mills, have also been suggested. But combinations of bar, wire rod, sheet, and pipe producers, when they have included the independent mills, have not

enjoyed a continuous existence and have never been conspicuously successful. The proposal that the rolling mills as buyers unite in a combination to present a solid front to half-products manufacturers was adopted in the Association of Half-Products Users; the result was a flat failure.[1] A cartell of independent rolling mills cannot hope to impose a satisfactory scale of prices upon producers as independent as are the members of the steel syndicate.[2]

VI. The Steel Syndicate and Middlemen

Of the three groups of products controlled by the syndicate, only structural steel was of any importance to the iron trade. Railroad material was usually sold in large quantities, especially to the railroad directories of the various German states. Even before the formation of the syndicate, the steel works had been accustomed to bid for and execute orders without the interposition of middlemen. A large part of the half-products was handled in the same way. Consequently when the syndicate assumed control of these groups of A-products it proceeded to sell as before. In structural steel, especially beams, wholesale and retail iron dealers played a more prominent part. The variety of dimensions, the large number of small purchasers as compared to other A-products, and the large territory over which the demand is spread, had brought it about that the beam business was transacted through wholesale dealers who in turn supplied the local jobber, the retailer, or large consumer.

[1] The Kartell Rundschau referring to the resuscitation of the Association of Half-Products Users in 1908 says "as usual it is a union out of which the manager has benefitted most." 1908, p. 732.

[2] The abolition of the tariff as a remedy for the situation of the independent rolling mills is taken up in the section upon price policy.

The beam cartell of older days had used its influence to bring about organizations of dealers which came into intimate relations with the producers' combination and whose policy was largely directed by it. Consequently there were at the time of the organization of the steel syndicate four associations varying in form from a loose price and terms agreement to a firmly constituted cartell with a sales-agency stock company.[1] To each of these was assigned a definite territory.

Altho there was some fear that the new steel syndicate would attempt the elimination of the wholesale trade when it replaced the beam combination in 1904, the system of distribution through dealers' associations was considered worth retaining, and the syndicate accordingly proceeded to organize dealers along the same lines. Territory was assigned to the four groups as before, while a special arrangement was made between the syndicate and a number of individual firms exploiting the Upper Silesian territory.[2] Any German wholesale dealer in beams who had earlier purchased his requirements from the beam cartell and who in the three years prior to 1904 had bought at least 3000 tons annually was entitled to membership in one of the beam dealers' associations.[3] Such dealers were supplied directly by the syndicate, a privilege not extended to smaller dealers, who were thus made dependent upon the larger wholesalers. The entrance of new members into the associations for the three years for which the contracts were to remain in force was expressly forbidden, the effect being to protect existing dealers against new com-

[1] These were the Beam Sales Office of Berlin organized earlier, the Rhenish-Westphalian, the Northwest and Middle German, and the South German Beam Sales Associations. For particulars cf. Denkschrift, pp. 67, 68, 477 et seq.; Kartell Rundschau, 1904, p. 545.

[2] For the exact territory covered by each association cf. ibid., 1904, p. 546; Denkschrift, pp. 472, 474. Also Liefmann in Kartell Rundschau, 1906, p. 495.

[3] Bonikowsky, Industrielle Kartelle und der Handel, p. 232.

petition at least with syndicate products. With the exception of the right reserved to supply a few large consumers using from 3 to 6 per cent of the total, the steel syndicate agreed to market all its structural steel through the dealers' associations.[1] As a means of combating outside competition, the cartell required all dealers to purchase exclusively from it, under penalty of a surcharge of five marks per ton on all purchases from the syndicate if outsiders were also patronized. The recognized district associations coöperated with the steel syndicate in fixing the prices and terms to be prescribed by the member dealers.[2]

Aided by groupings in various cities,[3] these associations have continued to function, tho not without changes in organization, usually in the direction of greater firmness. Their existence has at times been threatened by outsiders dealing in steel procured elsewhere than from the syndicate. And to grant the concessions to the "works dealers"[4] in 1907, the steel syndicate was compelled to order a 40 per cent reduction in the allotments of structural steel to the beam associations, an action which almost precipitated a crisis. The dissolution of all the associations was averted only with great difficulty.[5] During 1911, it was reported that members were cutting prices secretly in order to swell sales for that year, in order to enlarge the basis for the measurement of allotments in connection with the

[1] A few firms purchasing less than 3000 tons formerly supplied directly by the beam syndicate, continued to purchase directly from the steel syndicate, tho granted a somewhat smaller discount than the regular members of the associations. Bonikowsky, p. 233; Leisse, p. 145.

[2] The three main territorial groups of dealers united in 1905 to form a federation at the meetings of which prices and terms were determined. Kartell Rundschau, 1906, p. 495.

[3] Denkschrift, p. 68; Leisse, p. 144.

[4] See above, p. 270.

[5] Berliner Jahrbücher, 1907, pp. 112 et seq.; 1908, p. 131; 1909, p. 164; Kartell Rundschau, 1907, pp. 637, 781; 1908, pp. 741, 639; 1909, p. 58.

extension of the steel syndicate in 1912. The extension of the associations in the same year was clearly due to the pressure exerted by the producers' organization.

The steel syndicate has also attempted to control the wholesale trade in German steel in foreign countries. The wholesale dealers of Sweden, Holland, and Switzerland were organized upon the same plan as the German. In other countries, agencies in the form of stock companies were established. Representation in England was secured by the exercise of considerable pressure in the organization of a stock company, the Steel Works Union, Limited, composed of the former agents of individual German steel concerns. In some countries, selected firms were made representatives.[1]

The general influence of the steel syndicate has been to restrict greatly the freedom of middlemen. It has limited the number of dealers allowed to make direct purchases from the syndicate. It has exerted a deciding influence in the fixation of selling prices, as well as prescribing the buying prices of dealers. The volume of each dealer's sales is limited to his share of the allotment granted to the association. Dealers are required to buy exclusively from the syndicate under penalty of surchange and boycott — a serious restriction when syndicate prices happen to be considerably higher than prices quoted by outside producers. Speculative activity of dealers has been limited by the refusal of the syndicate to enter into long time contracts at fixed prices; and indeed its price policy tends to deprive speculation of its chief support, fluctuation.

On the other hand, the assignment of exclusive territory and the agreement of the syndicate to market structural steel exclusively through the associations with the protection thereby afforded against the rise of

[1] Bonikowsky, pp. 211, 234–36; Kartell Rundschau, 1904, pp. 706, 747.

new competitors, might be considered advantageous to dealers. The equality of treatment secured by membership in associations seems to have been nullified by the concessions granted to works dealers. It was asserted also that the policy of the syndicate in fixing buying and resale prices assured dealers of a profit whereas loss might result if dealers competed among themselves.

Thus it appears that the steel syndicate has not found it advisable to attempt the policy which many cartells have adopted — the elimination of the middleman.[1] Public opinion has undoubtedly played some part in deciding this attitude of the combination. But other factors, such as the intimate connection of certain members of the steel combination with wholesale iron firms, the fact that wholesale dealers have in some instances expanded their activities and become producers as well, and the tendency of the wholesale trade to invest capital in steel enterprises, thereby securing an influence in the determination of cartell policy — all these have been more potent in influencing the combination in favor of retaining the existing methods of distribution. And the allegation that products can be marketed at less cost through dealers than by means of a cartell organization, seems to have had some basis in fact.

VII. Conclusion

If one considers merely its price policy the steel syndicate might still be classed as a "good" combination.[2] Manufacturing buyers of half-products have at times been affected by a level of prices higher than the international level, but at other times have benefited by the moderation of syndicate policy. The difficulties of the

[1] Cf. Schaltenbrand's assertions in Kontradiktorische Verhandlungen, vol. iv, p. 410.

[2] Walker writing in 1906 so classes the Steel Works Union. Quarterly Journal of Economics, vol. xx, p. 398.

independent rolling mills seem to be due more directly to the increased production of B-products by competing plants under conditions making for a degree of efficiency and low costs which the non-integrated mills could not attain. The endeavors of the syndicate to control the distribution of heavy products and to organize the trade were as a whole not harmful, and may have resulted in some protection to buyers. With labor and labor conditions the cartell presumably had nothing to do, their regulation being left to the individual concerns.

Against the favorable, or not-unfavorable, effects of syndicate operation must be placed the results of the artificial stimulation given both directly and by way of reaction to the over-expansion of the iron and steel industry. By its magnitude and its unsoundness this development was sufficient to nullify any economies which may have been realized by the cartell. It is probable that the movement toward integration would have taken place more slowly had the iron industry been free from syndicate influence. As in the case of the potash industry,[1] there are reasons for being extremely doubtful whether the industry was in as good condition at the opening of the war as it would have been had competition prevailed.

There is no reason to believe that the excessive capacity of the German iron industry which existed in 1914 was deliberately planned. Nevertheless it must have been of immense value to Germany in the conduct of the war. The fact that some of the new plants erected by members of the steel syndicate are located in the Lorraine-Luxemburg iron ore region, very close to the French border, was an additional reason for Germany's contesting every foot of the attempted advance of the Allies, which if successful would involve the loss to

[1] Cf. my article in this Journal, vol. xxviii, p. 190.

Germany of strategically located munitions plants of most modern type.

Had the war not intervened, it is probable that a halt would have been called, perhaps through an economic crisis, to the extension of capacity beyond needs. The syndicate contract is due to expire during this year (1917); whether it will be extended is doubtful. The fact that one important member has already given notice of intended withdrawal may indicate dissolution and restoration of competition in A-products, followed eventually, when the war is over, by the deferred economic readjustment. On the other hand decision as to extension may be postponed until after the war, when in altered form it may be given new life and vigor as a means of rehabilitating foreign trade. Because of the interests of many members in Lorraine-Luxemburg iron and steel properties, the future of the syndicate, if extended, will be intimately connected with the disposition of territory in the peace settlement. But whatever happens in the way of economic readjustment after the war cannot be ascribed wholly to expansion due to war demands; it is to be ascribed to prior over-expansion.

The steel syndicate as the largest combination of steel producers in Germany, our strongest competitor upon the international steel market, possesses special interest for the United States at a time when extension of foreign trade is so actively encouraged. In both Germany and America the present combinations have succeeded a series of looser, unsatisfactory agreements, the futility of which had been amply demonstrated. The Sherman law left no step between resort to illegal secret agreements and the holding corporation or full consolidation. In Germany, on the other hand, the law has been favorable to a type of combination which, tho falling far short

of actual merger, insures unity of action for a term of years by means of legally enforceable contracts. In spite of the different forms and legal status of combination, the development of the steel industry in both countries has in one respect shown similarity. Within the German syndicate there has been from the outset constant rivalry between the members, reflected especially in connection with the demands for allotments. In the struggle to maintain their position in the syndicate and their existence in case of its collapse, they have in every possible way increased their size and strength. The result has been the concentration of a growing proportion of the iron and steel industry in the hands of a relatively few concerns, no one of which is of overwhelming size and power as compared to the others. In the United States, it seemed at one time that the organization of the Steel Corporation would introduce a concern of such power as eventually to permit competitors to exist only by its sufferance. But the subsequent rise of competitiors and the gradual decrease in the market control of the trust are bringing about, with respect to concentration, a situation not a little resembling that in Germany. It remains to be seen whether, in the development of a number of competing concerns, each large enough to secure maximum economy and efficiency of production, and marketing but not controlling a sufficient proportion of the output to prevent the free play of competition, some definitive solution of the trust problem is being approached.

H. R. TOSDAL.

TOTAL UTILITY AND CONSUMERS' SURPLUS UNDER VARYING CONDITIONS OF THE DISTRIBUTION OF INCOME

In discussions of the principle of consumers' surplus as developed by Marshall, the preliminary assumption has been that the diminishing utility curve might be represented by the demand curve and that marginal utility might be measured by price. This assumption is satisfactory for an individual, and may also be applied to a group of persons whose psychologic reactions to successive increments of all commodities are the same, provided that they have equal purchasing power. But in the case of a community whose members differ widely with respect to money income, the demand curve and the price no longer even approximately represent conditions of utility. The utility to the first purchaser, a millionaire, may be low, while the utility to the marginal purchaser, a worker in a sweat-shop, may be very high. The millionaire takes the first unit not because its utility to him is higher than to the worker but because the sacrifice involved in purchasing it is very much less.[1]

So much is familiar. The following analysis is an attempt to adapt the concepts of total utility and consumers' surplus

[1] The above principle is recognised by Professor Marshall. "A pound's worth of satisfaction to an ordinary poor man is a much greater thing than a pound's worth of satisfaction for an ordinary rich man," (Principles of Economics, 6th ed., p. 130). He thinks, however, that this consideration may be disregarded in practice, because "it happens that by far the greater number of the events with which economics deals affect in about equal proportions all the different classes of society; so that if the money measures of the happiness caused by two events are equal, there is not in general any very great difference between the amounts of the happiness in the two cases." This is undoubtedly true with reference to the events which Professor Marshall had in mind. If, however, the event in question were a socialistic proposal looking to the redistribution of income or even a drastic minimum wage law, this principle, far from being negligible, becomes the determining factor for justifying the innovation.

to a community with unequal incomes — a community such as we find in the actual world.

First, assume a group made up of four persons (A, B, C, D) having the same money incomes, and further assume them to be alike in their utility reaction to successive increments of some commodity, say, oranges. As successive oranges are offered, each yields a diminishing utility. For brevity suppose that we denote a unit of psychic satisfaction derived from an orange by u. Then the satisfaction derived from the first orange may be assumed to be $5u$; from the second, $4u$; from the third, $3u$; from the fourth, $2u$; from the fifth, u. Satiety is reached with the sixth orange — the orange becomes a free good.

Now so long as incomes are equal, utilities may be measured by money payments. The measures of $5u$, $4u$, $3u$, then become 5 cents, 4 cents, 3 cents, and so on.

If a dealer puts four oranges on the market, each person will take one orange at 5 cents; if he puts eight oranges on the market, each will take two at 4 cents; if twelve, three at 3 cents; and so on. Under the hypothesis, as so far advanced, diminishing utility and demand are both represented by the double line, PX, in Figure 1.

Throughout this discussion, A, B, C, and D are assumed to be aggressive purchasers in the order of the alphabet. That is, if only one orange were put on the market, it will go to A at 5 cents. B, C, and D would also give 5 cents, and not one of the purchasers would give more than 5 cents. But A gets the orange. In like manner, if two oranges are offered, they go to A and B; if three, to A, B, and C.

Next, let us suppose the incomes of the members of our community to be redistributed so that for A, B, C, and D respectively they will stand in the ratio of 4: 3: 2: 1. Since the amount of money in the community and hence the total money income is not changed, their money incomes will now be (assuming that before the change each income was x) $1.6x$, $1.2x$, $0.8x$, and $0.4x$. Now, under these conditions, as was noted in the first paragraph, utility curves can no longer be constructed and compared on the basis of the money pay-

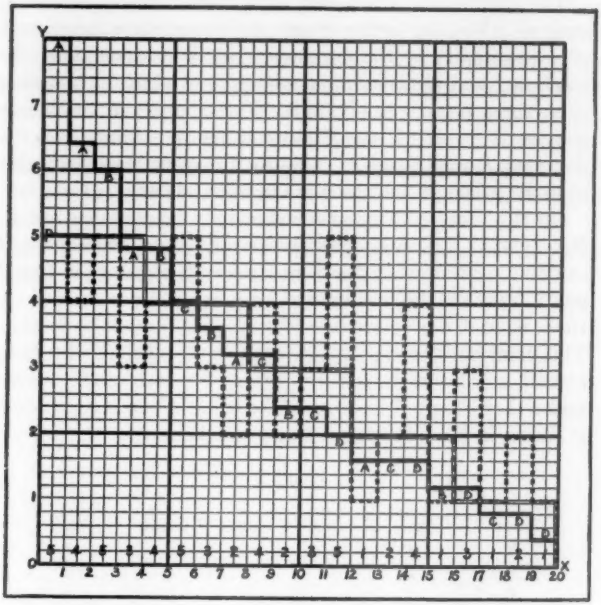

FIG. 1

Explanation:

Demand or utility line, equal distribution of incomes.

Demand line, unequal distribution of incomes.

Utility line, unequal distribution of incomes.

Figures below line OX indicate supply.

Figures above line OX indicate corresponding utility of last unit taken, unequal distribution of incomes.

Letters A, B, C, D, indicate recipients of successive increments of supply, unequal distribution of incomes.

ments which would be given for successive increments of the commodity in question. A curve constructed on this basis will indeed be a *demand* curve, but not a *utility* curve. In order to make a comparison for utility between persons of different money incomes on the basis of their demand curves, some hypothesis is necessary for reducing money payment to utility.

The hypothesis which will be assumed in the following analysis is that the utility of any of the successive increments of a commodity to the purchaser may be measured by the fractional part of his entire money income which he is willing to sacrifice in order to obtain it. For example, if A's income is twice B's, and if B would pay x cents for a thing, then the fact that A would pay $2x$ cents for the same thing indicates that the utility of the thing is the same to both.

On this basis, a demand schedule may be made out for A, B, C, and D, separately and collectively, under their changed incomes. Since, when their incomes were equal, each would pay 5 cents for the first orange, now, when A's income is 1.6 times what it was before, he will pay 1.6×5 cents, or 8 cents. This method of computation may be applied to the first, second, third, fourth, and fifth orange for each of the buyers under their changed incomes. The result of the computation is shown in the following demand schedule.

TABLE I

At	A takes	B takes	C takes	D takes	Group takes
8	1	..	..	..	1
6.4	2	..	..	..	2
6	2	1	..	..	3
4.8	3	2	..	..	5
4	3	2	1	..	6
3.6	3	3	1	..	7
3.2	4	3	2	..	9
2.4	4	4	3	..	11
2	4	4	3	1	12
1.6	5	4	4	2	15
1.2	5	5	4	3	17
.8	5	5	5	4	19
.4	5	5	5	5	20
cents	oranges	oranges	oranges	oranges	oranges

The demand "curve" for the group (derived from this schedule) is shown by the full-line steps (YX) in Figure 1.

Now if by consumers' surplus we mean nothing more than the money which the members of a community would have paid in excess of what they actually do pay, for a given supply

of a commodity, offered in successive increments, rather than go without it, then from a study of the above schedule and Figure 1 it at once becomes apparent that in this sense consumers' surplus is in general greater under conditions of unequal than of equal distribution of incomes, until the supply reaches satiety, when the two results will be the same. The last part of this statement is obvious, *a priori;* for at satiety the sum actually paid is 0 while the sum which would have been spent is the same in each case.[1]

The following table gives the consumers' surplus computed as above under different conditions of supply.

TABLE II

Oranges offered	Consumers' Surplus Equal distribution	Consumers' Surplus Unequal distribution
1	0	0
2	0	1.6
3	0	2.4
4	0	6.0
5	4	6.0
6	4	10.0
7	4	12.4
8	4	15.2
9	12	15.2
10	12	22.4
11	12	22.4
12	12	26.8
13	24	31.6
14	24	31.6
15	24	31.6
16	24	37.6
17	40	37.6
18	40	44.4
19	40	44.4
20	40	52.0
21 (Satiety)	60	60.0

[1] Under equal distribution A or B or C or D would each have spent 5 + 4 + 3 + 2 + 1 cents or 15 cents rather than go without the oranges. In all 60 cents. Under unequal distribution the amounts which would have been spent by each is shown by the following table.

A = 1.6 (5 + 4 + 3 + 2 + 1)
B = 1.2 (")
C = .8 (")
D = .4 (")

A + B + C + D = 4.0 (") = 60 cents.

But such an analysis of consumers' surplus is without significance. Consumers' surplus, as a constituent of psychic income, is to be defined as "the difference between the sum which measures total utility and that which measures total exchange value." [1] But when persons have different incomes, sums of money expended or which might have been expended no longer measure either marginal or total utility. Before they can do so they must be reduced to terms of equal income. When A, in the supposed case of unequal income buys his first orange for 8 cents he is obtaining a utility of $5u$ and is making a money sacrifice (in terms of any other commodity he might have purchased) also of $5u$. In like manner the second orange at 6.4 cents represents a utility of $4u$ and a money sacrifice of $4u$. If only two oranges are offered, A gets them both at a money sacrifice equivalent to $4u$ each or $8u$ for both. Rather than go without them he would have made a money sacrifice equivalent to $9u$. He thus gains what may be called a "real" consumers' surplus of $1u$. Now if incomes had been equal and only two oranges had been offered, A and B would each have obtained an orange for 5 cents and each would have represented a utility of $5u$. Since by hypothesis neither would have paid more than 5 cents there would have been no consumers' surplus. It thus appears that "real" consumers' surplus, as above interpreted, may also be greater under inequality of income. It would be possible to determine the consumers' surplus in this sense for every increment of supply from two oranges to twenty-one. It may be worth while to note that in this sense also the consumers' surplus when satiety is reached will be the same for any distribution of income. But except for this comparatively unimportant deduction the investigation would be of little worth. At any rate it has no significance in comparing the well-being of a community having unequal distribution of wealth with one having equal distribution. For the consumers' surplus of those who purchase goods because of larger means rather than because of greater marginal utility is to some extent offset by a consumers' deficit

[1] Taussig, Principles of Economics, vol. i, p. 128.

(so to speak) on the part of those who are unable to purchase at all, because of insufficient means, even tho the goods have high utility.

To compare the well-being of the two communities the method of consumers' surplus is therefore inapplicable. Yet the method outlined above may be employed to compare them with respect to total utility as successive instalments of goods are offered; and this comparison will be significant. Using the same assumptions as in the case of "real" consumers' surplus we derive the following table.

TABLE III

Oranges offered	Total Utility Equal distribution					Total Utility Unequal distribution				
	A	B	C	D	Group	A	B	C	D	Group
1	5	..	..	..	5	5	..	..	..	5
2	5	5	..	..	10	9	..	..	..	9
3	5	5	5	..	15	9	5	..	..	14
5	9	5	5	5	24	12	9	..	..	21
6	9	9	5	5	28	12	9	5	..	26
7	9	9	9	5	32	12	12	5	..	29
9	12	9	9	9	39	14	12	9	..	35
11	12	12	12	9	45	14	14	12	..	40
12	12	12	12	12	48	14	14	12	5	45
15	14	14	14	12	54	15	14	14	9	52
17	15	14	14	14	57	15	15	14	12	56
19	15	15	15	14	59	15	15	15	14	59
20	15	15	15	15	60	15	15	15	15	60

Comparing the total utilities for the group it appears that for every condition of supply of over one orange or less than nineteen the total utility enjoyed by the group is less under conditions of unequal distribution of incomes than under equal distribution. The comparison of total utilities under the two conditions of distribution may also be made directly from the diagrams, Figure 1, Figure 2, the total utility for equal distribution being the area below the double line PX,

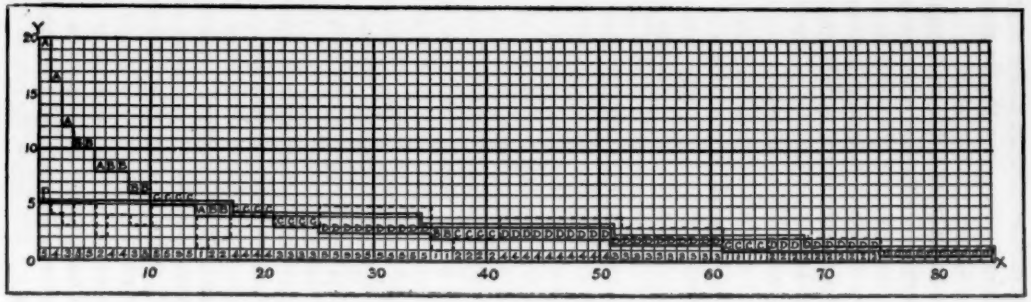

FIG. 2

Explanation:

Demand or utility line, equal distribution of incomes.

Demand line, unequal distribution of incomes.

Utility line, unequal distribution of incomes.

Figures below line OX indicate supply.

Figures above line OX indicate corresponding utility of last unit taken, unequal distribution of incomes.

Letters A, B, C, D, indicate recipients of successive increments of supply, unequal distribution of incomes.

and extending to the ordinate corresponding with the supply; and the total utility for unequal distribution being the area, to the same ordinate, below the dotted line, PX.

The utility "curves" corresponding with Table III are shown in Figure I, the double line, PX, indicating utility when incomes are equal; the dotted line, PX, when incomes are unequal. The ups and downs of the latter line clearly show that under conditions of unequal distribution of incomes the taking of successive "doses" of a commodity no longer indicate a steadily diminishing utility to the purchaser. The twelfth orange, for example, has for its purchaser a much higher utility than the tenth has for its purchaser.

This method may also be employed to compare the well-being of a community under equal distribution of income with that of the same community divided into non-competing groups having different incomes for the members of different groups. Assume a society made up of four non-competing groups, A, B, C, and D, with one person in group A, two persons in group B, four in group C, and ten in group D—seventeen in all, and assume individual incomes for the members of the groups to be in the ratio A: B: C: D = 8: 4: 2: 1. Assume the utility of oranges to members of all the groups to be as in the first problem. Then under conditions of equal income seventeen oranges would be taken at 5 cents, thirty-four at 4 cents, and so on, as shown by the double line, PX, in Figure 2. If under equal distribution each person has an income of x cents, then when the incomes are redistributed in the assumed proportions, each person in group A will have $4x$ cents; in group B, $2x$ cents; in group C, x cents; and in group D, $\frac{1}{2}x$ cents. From this we may construct the demand schedule on p. 316.

The last column of this demand schedule is represented by the full line steps YX, in Figure 2, the letters A, B, C, D, indicating the recipients of successive oranges. If, now, we multiply each money payment of A by $\frac{1}{4}$, of B by $\frac{1}{2}$, of C by 1, and of D by 2, we can construct the utility "curve" shown by the dotted line, PX. As in the former case it will be noted that under conditions of unequal incomes marginal

TABLE IV

At	Each A takes	Each B takes	All B's take	Each C takes	All C's take	Each D takes	All D's take	Whole Community takes
20	1	..	..	..	..	..	..	1
16	2	..	..	..	..	..	..	2
12	3	..	..	..	..	..	..	3
10	3	1	2	..	..	..	..	5
8	4	2	4	..	..	..	..	8
6	4	3	6	..	..	..	..	10
5	4	3	6	1	4	..	..	14
4	5	4	8	2	8	..	..	21
3	5	4	8	3	12	..	..	25
2½	5	4	8	3	12	1	10	35
2	5	5	10	4	16	2	20	51
1½	5	5	10	4	16	3	30	61
1	5	5	10	5	20	4	40	75
½	5	5	10	5	20	5	50	85
cts.	Oranges							

utility may increase as well as diminish with successive increments of supply. The total utility is shown by the area below the double line, PX, when incomes are equal; or below the dotted line, PX, when incomes are unequal. Computations of these areas yield the schedule on p. 317.

As before it will be noticed that between one orange and satiety the total utility is in general greater for equal than for unequal distribution of incomes.

We have assumed that the same kind of goods (oranges) are consumed whether incomes are equal or unequal. This would probably not be true in life. When incomes are unequal, altho A would give 20 cents for his first orange rather than go without it, he would probably prefer to give 20 cents for something having a higher utility than an orange (say a grape fruit) which was before inaccessible but now becomes accessible because of his greater purchasing power. In like manner each D, if the price of an orange were beyond his purchasing power, would probably take something of less utility, but

TABLE V

Oranges offered	Total Utility	
	Equal distribution	Unequal distribution
1	5	5
2	10	9
3	15	12
5	25	22
8	40	32
10	50	38
14	70	58
21	101	79
25	117	91
35	156	141
51	204	191
61	224	221
75	245	245
85	255	255

cheaper (say, an apple). Inequality of incomes, therefore, leads to the production of types of goods, covering a greater range of expensiveness than equality of incomes.

Again, the objection may be made to the above method of analysis that as a person spent his money its marginal utility would increase and that therefore it would be inaccurate to multiply the utility of successive oranges by a *constant* derived from the marginal utility of money, to find what a person would spend. This is a matter of psychology. The objection would be valid if we consider each person as starting with an unreplenishable fund which he is steadily depleting. If, however, we consider the money as an income received in instalments contemporaneously with the spending the objection would be covered. In the case of incomes received by the week or month the matter is largely one of individual psychology. To some persons the utility of a dollar seems about the same during the entire interval between successive instalments of income. To others undoubtedly a dollar seems much more precious towards the end of the month than immediately after pay day.

Considerations such as these must undoubtedly preclude the hope of attaining mathematical precision in applying our analysis to real life. Indeed, such precision cannot be expected

from any analysis of so ideal and personal a thing as psychic income. The mathematical method, however, is often valuable in helping us to perceive and grasp a truth even where its results are not to be taken too literally; and no more is hoped for it in the present instance.

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REVIEW

THE CARNEGIE HISTORIES OF COMMERCE AND OF MANUFACTURES[1]

STUDENTS of American economic history have awaited with eagerness the publication of the investigations made under the auspices of the Carnegie Institution of Washington into our past economic life. It was thirteen years ago that the plans for the eleven, later twelve, " divisional " studies were laid. Men qualified for the tasks were then chosen to supervise the formulation of these studies, and work was begun in 1904. But, as Professor Farnam writes in the introductory note to the volumes on commerce, " work of this kind is slow at best, and the completion of divisional volumes has been retarded in many cases, not only by the demands made upon the collaborators to undertake other responsibilities, but also by special mishaps." The first study to be issued of these " Contributions to American Economic History," as the series is to be called, was the *History of Domestic and Foreign Commerce of the United States* (1915), in two volumes, some seven hundred pages in all, prepared under the guidance of Professor Emory R. Johnson. This has been followed (1916) by an instalment of about the same bulk, altho published in a single volume, on the *History of American Manufactures*, written wholly by Dr. Victor S. Clark and covering the period 1607 to 1860. Such studies, attempting to carry further than ever before a systematic investigation of our commercial and industrial history, and sustained by the resources of the Carnegie Institution, deserve the closest

[1] E. R. Johnson and collaborators, History of Domestic and Foreign Commerce of the United States, vols. i and ii, Washington, Carnegie Institution of Washington, 1915, 2 vols., pp. 363, 398. Victor S. Clark, History of Manufactures in the United States, 1607–1860, Washington, Carnegie Institution of Washington, 1916, pp. 675, (with an Introductory Note by Henry W. Farnam).

attention of all economic students. Future numbers in the series should be scrutinized no less carefully. The contributions represent the endeavor, under the best auspices, to present American economic history in its principal aspects.

The *History of Domestic and Foreign Commerce of the United States*, to which Professor Johnson's name is attached, is avowedly the work, not of that scholar alone, but of others as well. He states in the preface that when undertaking the task in 1904 he had intended to write the whole. He found it impossible, however, to carry out this plan, and secured the assistance of Drs. T. W. Van Metre and G. G. Huebner, of the University of Pennsylvania, and of Dr. D. S. Hanchett, formerly connected with that institution. The division of work among these collaborators is roughly as follows: Professor Johnson himself wrote the earlier chapters, dealing primarily with the colonial period; Dr. Van Metre covered the parts on internal commerce, coastwise trade, and on the fisheries; Dr. (now Professor) Huebner was author of the part on foreign trade since 1789; and Dr. Hanchett was author of the final section, concerned with government aid and commercial policy. Volume I contains the parts on colonial commerce, internal commerce, and coastwise trade; and Volume II, those on foreign trade since 1879, the fisheries during the same period, and government aid and commercial policy. A glance at these titles, or better a brief inspection of the chapter headings, discloses the wide scope of the work.

Still wider appears the scope upon perusal. Matters as diverse as the commercial companies that sent out the first colonists and the present organization of the consular service, the development of the oyster culture and the expanding basis of our export trade — all find place. The purpose seems to have been to give as comprehensive and serviceable an account as possible. The commercial aspects of the colonial era have, indeed, been studied before, and have hitherto had in fact more than their share of attention; but our external or domestic trade, our fisheries, governmental assistance and commercial policy, have never had the

extended treatment here given. Monographic or briefer studies (Day, McFarland, Tower, and others) may well for some purposes be superseded. It is these formulations upon the main divisions of our commercial history that give the work its greatest value. They should be of considerable utility to the general reader, and may perhaps serve in some measure as divisional ground-plans for the more stable structure which sometime must be built. The adequacy of these plans will later be taken into account.

True, some distinct contributions are made. On certain matters information hitherto not readily available or digested is put within reach. In the study of the fisheries, Dr. Van Metre has passed the bounds of McFarland's book in some respects. He considers not merely the fisheries of the New England coast and northward, but also those of the southern, Gulf, and Pacific coasts and fishing grounds. He brings into correlation with the earlier narrative such recent material as the Census Report on Fisheries of 1908. The discussion of the Alaskan seal fisheries also contains much that is new, and the chapter on fisheries as an international question gives a good summary of the arbitration proceedings both in relation to the North Atlantic coast fisheries and the fur seals. On the whole, so far as original contribution is concerned, this section is the best in the two volumes. Comparing favorably with it, however, is the concluding part on government aid and commercial policy, written by Dr. Hanchett. The treatment of the recent history of the consular service is good, and the portions on the improvement of rivers and harbors, while general and sketchy, hold some new material. In the remaining fields, the formulation of the rather brief history of the coastwise trade is done with most originality. The analysis of the laws protecting and regulating coastwise shipping and the superficial analysis of intersectional exchange are better than what has before been brought together.

In making a just estimate of the volumes, however, it is necessary, I believe, to consider more than the contents as they stand. One should bear in mind the ideals of scholarly

work. One should take into account, further, the circumstances under which the volumes were prepared and the period over which that preparation extended. Aid was given in their elaboration by the Carnegie Institution; and they are supposedly the fruition of some ten years' prolonged, if interrupted, labor. Judged merely on the basis of scholarly method, the volumes would fare none too well. Judged by the more adequate standard of scholarly method in conjunction with the other circumstances, they must be rated as falling far short of full measure.

Throughout the volumes, there is a tendency to use readily available material, often secondary sources. Some of the latter (and of these the use is acknowledged) might indeed be legitimately utilized, since they were, to some extent, assisted in their composition by the Carnegie Institution itself. In point of fact, they are used freely: such as Professor Giesecke's little book on *American Commercial Legislation before 1789*, Dr. Tower's *History of the Whale Fisheries*, Professor J. R. Smith's *Organization of Ocean Commerce* and his *Ocean Carrier*, and Dr. C. L. Jones's *Consular Service of the United States* (1907). But these works had been already given to the public, and their utilization meant merely restatements of greater or less extent. Other works whose use is acknowledged, and which may have been assisted by the Institution, are unpublished. These include an "elaborate" and as yet unpublished account of the foreign trade of the United States, prepared by Professors S. S. and G. G. Huebner; a history of the coastwise trade, by Professor Thomas Conway; and a history of the fisheries of the United States outside of New England, written by Dr. W. S. Tower in 1906 and 1907 (i. e., before the publication of such valuable material as the Census Report on Fisheries of 1908). In other portions of the work, the bulk of the information seems to have been drawn from sources which, if not secondary, are at least readily available and require no real research. For example, McFarland's *New England Fisheries* and Du-Bois's *Suppression of the Slave Trade* form the basis of chapters or parts of chapters, while among sources readily

at hand should be mentioned Pitkin and Seybert, Census and other governmental publications of a statistical character, and the series of reports on various phases of domestic trade which appeared in the *Monthly Summary of Commerce and Finance* in 1899–1901. Taken as a whole, the work suffers from a lack of independent research and constructive interpretation. It will be noted that the contributions spoken of above are in the main concerned with secondary matters, the fisheries and governmental activity. Our first interest is, of course, in the histories of the foreign and domestic trades. In these, if we except the compilation of readily available statistics, and especially if we exclude the partial offerings on the coastwise trade, little new is to be found. In general, the work is of the sort which an investigator or compiler working alone and unaided might have put together, not such as to exhibit fruition of some ten years' subsidized endeavor. Where the "going" appears easy or the way has been marked out, there the exposition proceeds apace; where original investigation is necessary, there it halts. This is not the type of product anticipated from the great undertaking, and so is disappointing.[1]

The work as a whole suffers also from the very method of its composition. All collaboration is difficult; but in this case the gains from collaboration hardly outweigh the evils. It will suffice to suggest a few points. The subject matter is divided longitudinally, as it were; one reads the entire history of the internal trade since 1789, and then retraces the years for a view of the foreign commerce. At the beginning, it is true, an attempt is made at cross-section work, at division by chronological periods, when two chapters, one on the fisheries

[1] In marked contrast to the methods employed in this history are those used by Professor Isaac Lippincott in his recent monograph called the Internal Trade of the United States, 1700–1860, published in the Washington University Studies. The title is, in fact, misleading. It is a history of commerce in the Mississippi valley. The monograph is excellent. It is thoro and represents scholarly research; it is well documented; and it makes real contributions, especially in tracing the rise of trade centers. It is to be hoped that Professor Lippincott, having extended his researches from his earlier special studies (one of which, The History of Manufactures in the Ohio Valley up to 1860, he wrote with the assistance of the Carnegie Institution) to this fairly broad thesis, will be able to advance further until we have a really thorogoing history of our domestic commerce.

and one on the coastwise traffic of that period, are included in the part on colonial commerce. But, for the period after 1789, this plan is abandoned. Some attempts are then made to tie together interdependent sections of the work; but they are either incompletely done or necessitate much repetition. Thus, the economic development of the United States since the Civil War is dealt with in the part on internal trade, receiving little or no attention in the part on foreign trade. A conspicuous example of repetition appears in the treatment of governmental activity as regard commercial treaties and aids to shipping. Chapter 30, written by Professor Huebner, on commercial treaties of the United States, deals primarily with general and special trade agreements, but also with shipping and navigation treaties; chapter 39, by Dr. Hanchett, on the policy of the United States towards shipping and ship-building, has, of course, also to include reciprocity agreements as well as other governmental assistance; and the final chapter, entitled Tariff Provisions Concerning the Shipping and Foreign Trade of the United States and written by Professor Huebner, contains largely repetitious material both on trade treaties and shipping agreements. Indeed, there seems to be little more justification for the insertion of this last chapter, instead of distributing such new points as are in it to their proper place than that it enables Professor Huebner to reprint (with certain additions to bring it to date, but to a large extent verbatim) an article published in the Annals of the American Academy for May, 1907.

Again, when repetition becomes necessary on account of the plan of the work, varying interpretations occur. For example: Professor Johnson, in discussing English colonial policy, writes (vol. i, p. 49), " The laws for the restriction of the manufacture of woolen goods, hats, and iron products, were successful, but the effects could scarcely have been important. The colonists could not have made woolens in competition with England either for export to Europe or for the intercolonial trade; nor would the manufactures of hats, if unrestricted, have had much development." Dr. Van Metre, however, in giving reasons for the small growth of

coastwise traffic in the same period, ascribes it in part to the prohibitions on manufactures (vol. i, p. 169): "Boston would unquestionably have been the center of a considerable coastwise trade in domestic woolens, had it not been for the repressive policy of England. The hat-making industry of the northern colonies was also restricted, and as a consequence there was little trade in colonial manufactures." In another case, Professor Huebner and Dr. Van Metre are in disagreement. The one (vol. ii, p. 40), stresses the poor transportation facilities, as "a powerful obstacle to the ready movement of imports and exports" during the period 1815 to 1830; while the other emphasizes improvements in transportation in that period (vol. i, pp. 213, 220) and adduces the small increase of imports during the decade of the twenties as evidence of the commencement of "a tremendous expansion of domestic trade" (p. 222). Discrepancies of this kind would not have as much weight, were there countervailing gains from the collaboration. Such, however, are not observable. There is no gain in intensity of investigation or in interpretative insight.

Matters of internal arrangement call for attention. It is open to question, for example, whether the account of the fisheries might not better have formed a separate monograph, even tho still included in this "divisional" treatise and prepared under Professor Johnson's supervision. Except in the colonial era — where a special chapter on the subject is incorporated in that part of the work and some comment is made on the West Indies trade — the history of the fisheries is nowhere linked either with internal or foreign commerce. No doubt, it fits as well into the study of commerce as into any other of the divisional groups: but the attempt to incorporate it as an integral part of a study of commerce seems a mistake. The authors, too, seem to have realized its anomalous position. In general, everything regarding government assistance to this industry, international agreements concerning it, and internal trade in its products, is kept distinct from the discussions of these subjects in relation to commerce as a whole. Everything in

regard to fisheries, except for the colonial period, is placed in the part devoted to American fisheries since 1789. Had the authors carried their views to the logical conclusion, they would have relegated this part, with the chapter on the colonial period, to the close of the second volume, and changed the title of the whole to a " History of the Domestic and Foreign Commerce and of the Fisheries of the United States."

On the other hand, cleavage is in another relation carried too far. The " coastwise " and the " internal " commerce are in reality but branches of the " domestic " trade, and of course should not be separated into individual parts. No good reason can be found for such division. In fact, the author of both sections, Dr. Van Metre, found it impossible at times to keep the two wholly within the compartments where they were placed. Note, for example, the domestic movement of cotton (vol. i, pp. 247, 251, 281).

Certain other cases of objectionable arrangement, tho of less importance, should be mentioned: the chronological division of our commercial history, foreign and domestic, at the year 1900; the separation of the chapter on commercial treaties from the part on government aid and commercial policy; and the insertion of appendices and bibliography on the colonial period, not only in the middle of a volume, but between chapters of a part.[1] Of these, of course, the first is most important. Undoubtedly, something may be said for the year 1900 as a dividing point, especially in view of the material at hand in the reports of internal trade, which appeared in the *Monthly Summary of Commerce and Finance*, as above-mentioned. Yet the choice of 1900 is not strongly defended in the work itself. Of the internal commerce, it is said (vol. i, p. 318): " The general character of the internal commerce of the United States during the opening decade of the twentieth century showed but little change;" and of the foreign trade (vol. ii, p. 86) while there has been an " extraordinary growth," . . . " the conditions existing during the closing years of the nineteenth century foreshadowed

[1] It might be further asked, what is the map on the Panama Canal routes doing alone and neglected? It is inserted (vol. ii, opposite p. 120) and is not referred to in the text, which deals with tramp and line traffic.

many of the changes which have since occurred." The year 1890 would seem on the whole more significant. The changes which then began in the character of our exports and imports, the initiation of governmental regulation, both of transportation and combination, and the reconstruction of our manufactures under the stress of combined depression and first low tariff after the Civil War — these all point to the earlier date.

Disproportionate assignment of space sometimes occurs. A conspicuous case is to be found in the chapter on the trade with our non-contiguous possessions, which receives a share of attention based on a popular rather than a scientific consideration of its importance. How much space would have been granted it, had these countries not happened to belong to the United States? It occupies in fact nearly as many pages as the discussion of our foreign trade from 1860 to 1900; while the foreign iron and steel trade during this period receives less space than the trade of the last fifteen years with Porto Rico.

Finally, omissions and inadequacies bulk large. There is an almost entire lack of study into the qualities in commerce, that is, into the kinds and grades of commodities appearing in trade movements. As a result, silk goods and glassware are treated as if at least as homogeneous as wheat or coal, and no adequate attempt is made to explain the import and export of the same group commodity — say, cotton fabrics. Again, no sufficient mention is made of the technique of fishing, such as the improvements of vessels and of fishing equipment. Comparatively little notice is given to the competition of various ports in more recent times, with the problems of differentials and port facilities; altho for the earlier period the relation between competitive coastal cities and the development of transportation facilities is pointed out. More serious than any of these, is the omission of any sufficient treatment of marketing. Altho the chapters denominated the Organization of Commerce, as regards both domestic and foreign trade, contain much that is important to the study of commerce, such as the development of com-

munication and transportation, banking and marine insurance, they ignore, for the most part, subjects that are equally pertinent, such as the rise and changes in collective and distributive centers, the growth of standardization, and especially the formulation of our present sales structure. The whole subject of marketing methods, with the exception of produce exchange and foreign export operations, is dismissed with the easy phrase, that " it will be unnecessary to discuss " these matters (vol. i, p. 300).

In sum, it may well be questioned whether the advantages and contributions of the work will enable it to survive the damaging influence of its defects. Tho it may be the fullest account of our commercial history that we have, yet its value is diminished by the indifferent, and in places even poor, quality of its composition, and by the considerable gaps in the outline. The presentation of certain new material is no doubt of importance; but the general character of the volumes, with their inadequate documentation and their great reliance on secondary and readily available sources, lowers the total worth. Especially are they disappointing as the outcome of a decade of preparation combined with the assistance of the Carnegie Institution. They would seem to represent the labor of perhaps a year or so, not of ten years. Indeed, there are unmistakable evidences, in parts, of hasty composition, particularly in relation to the English colonial policy. Thus, it is said, (vol. i, p. 86) that indigo was never " enumerated " during the colonial period. Nor does Professor Johnson always give the same interpretation of this policy. He writes in one place (vol. i, p. 107) that " it is well . . . to remember that the purpose of the mother country was to foster as well as to regulate and tax the commerce of the colonies; " but in a few pages (p. 123), he falls into the old fallacy that " the Revolution was caused primarily by the mercantile policy by means of which Great Britain sought to monopolize the trade of her colonies for the benefit of the people at home."

The value of the work as a " contribution " to American economic history must be set down as doubtful. It does not

come up to the ideals of scholarship. Little analytical or constructive acumen is manifested. The best that can be done is, perhaps, to cull from it the additions which it does make to our stock of information, for the first-rate history of our domestic and foreign commerce which is yet to be written.

The *History of Manufactures in the United States* from 1607 to 1860, written by Dr. Victor S. Clark, is in most respects different from the work already reviewed. Outwardly and inwardly the two are dissimilar. They differ in externals: Dr. Clark's book would have made two volumes of moderate thickness after the fashion of the *History of Commerce*, yet is published in a single ponderous volume of somewhat larger page. One wonders if all the studies in the series are to vary. As regards contents, the advantage is all with Dr. Clark. Whereas the collaborators of the volumes on commerce were content with easily obtainable material and with a broad, general account, he has been satisfied in the main with primary sources only and has undertaken a closer, much more detailed discussion. The thoroness, the documentation, the carefully organized and coherent presentation of his subject all suggest the time and energy which have been put into the book and demonstrate the scholarship that directed its composition.

The *History of Manufactures* manifests distinctly the gains from single authorship. The material is dexterously made to fit into its proper place for the fulfilment of the author's purpose. The history is divided into but two main sections, the chronological periods 1607–1790 and 1790–1860. Within these main sections are arranged cross-section chapters, covering natural resources, foreign influences, and similar major sub-divisions. Under this method of organization, the industries of the country sweep forward in a body, and the vicissitudes of the individual members are merged into the onward movement of the whole. It is not a compilation of the histories of individual industries, but a narration of the gradual, steady advance of American manufactur-

ing enterprise. And this exposition is accomplished with a clarity and firmness of cohesion which only exceptional collaboration could have given.

Thoroness of treatment is evident in all phases of the work. The main cross-sections include not only examination of natural resources and foreign influences, but also discussion of the influence of the tariff, the growth of transportation facilities, assistance from all forms of government, organization of industry, and technical progress, as well as the more usual accounts of the extent and the geographical distribution of manufactures. Particularly gratifying is the appearance of the chapters on technical progress and industrial organization. So too, not only are the more familiar manufactures dealt with, but also the somewhat neglected industries, such as flour-milling and distilling, silverware and agricultural implements, machine tools and steam engines Special notice, finally, should be given to the bibliographical richness of the volume. All published monographs and more general studies, the letters and writings of prominent men, the archives of colonial and state governments, the treasures of the British Museum, local histories, and even the papers and account books of individual firms (it is unfortunate that Dr. Clark did not learn of the wonderful collection of the Slater records, now loaned to the Harvard Library) — are all consulted and their evidence woven into the texture of the story. Instructive appendices contain tables of prices for such products as pig iron, flour, and satinets, and an excellent bibliography of available sources.

A further point of contrast between this volume and those on Commerce is to be found in the interpretation of the assembled facts. Dr. Clark's lines of attack and his conclusion are often novel and usually suggestive. Besides his treatment of industrial organization, which will be discussed shortly, I have chosen for illustration a few other points. His discussion of the English colonial policy, in contrast to Professor Johnson's, is clear-cut, coherent, and judicial. In keeping with it, his conclusions are sound: that "upon the whole the industrial development of the colonies was about

where it would have been had their economic policies been governed by their own people. Natural influences were vastly more important than political policies in determining that development" (p. 30). Again, Dr. Clark has followed an interesting and important line of inquiry, when he traces the sources of the capital which was invested in early manufactures. The accumulations of mechanics and of the owners of small shops and mills, he finds, were used for the up-building of larger establishments. Commerce furnished another source even more considerable. But his final factor is of most interest: he writes that "industrial capital, however, has been its own chief progenitor. The high profits normally enjoyed by manufacturers supplied a surplus for new enterprises and created confidence in their success" (p. 369). The author's treatment of technical advance is likewise noteworthy. While at times he seems tempted to exaggerate the importance of American inventions, on the whole he gives foreign influence and advantage their due. His further point is novel: while, "as a matter of history," British industrial technique was for a half century "constantly so far ahead of that of the United States that our manufactures always were in the position of learners from the older country," yet "no feature of this apprenticeship . . . was more characteristic than the originality" of the latter. "This was no period of mere passive borrowing and painstaking imitation of the achievements of maturer industrial countries. Foreign inventions were assimilated as readily as foreign populations, and were speedily transformed into the machinery of a truly native system of production" (p. 262). Finally, his consideration of the tariff is gratifying. He holds no brief either for protection or free trade. He seems to attach more importance to the psychological influence of the tariff and to its influence on market stability than to any other feature of its effects. One could hardly differ from his conclusion: "The total effect of protection was to encourage manufactures; some early outgrew the benefits of this influence; others continued to be sustained solely by its support; others were more hampered than aided by the complex of con-

ditions with which this legislation surrounded their operations" (p. 312).

Such a study, with its orderliness, its thoroness, and its stimulating interpretation is what economists had expected from the Carnegie Institution and from the investigators chosen to represent it. It covers a greater multitude of sources than a single, unaided student could well consult; and it does the work under thoughtful organization and with considerable imaginative insight.

Some particulars, however, seem to call for comment. First, it may be remarked that a certain antiquarianism is observable in the treatment of the colonial period, to which considerably over a third of the volume is devoted. A chapter, unlike any other in the book, is inserted containing a review of contemporary accounts of colonial manufactures. More important is the exaggerated emphasis placed upon manufacturing developments before the Revolution, and for that matter before the Embargo and the War of 1812. Dr. Clark's formulated conclusions as regards the colonial manufactures are conservative enough, as far as they go. He takes a position midway between the extremists, the disdainful loyalists and exuberant patriots whom he quotes, maintaining that the country was essentially self-sufficient by the time of the Revolution. This is unquestionably true; but he neglects to point out with proper force that, barring a few exceptions, it was a self-sufficiency based not upon centralized production and exchange but upon family or strictly local production. Reading the book, one feels that the commercial side of colonial manufacturing, the fortuitous or ephemeral entrance of manufactures into trade, and the emergence of short-lived establishments are "played up" too much. The true picture is given elsewhere by Dr. Clark himself, when he is speaking of the beginning of the next stage of development (p. 235);—and what he says there would of course be even more true of the colonial times. Despite some improvement in water transportation, "land communication was still expensive and difficult. Power-using manufactures were dispersed among a multitude of village water mills, thus proving their continued

dependence on adjacent materials and markets. The self-subsisting farm household remained the typical economic unit of rural America; and homespun[1] industries still supplied a large part of the nation's consumption."

Second, the division of the history of our manufactures at the year 1790, may be brought into question. No doubt, something may be said for Dr. Clark's position, but there are, I believe, objections. During the period from the adoption of the Constitution to the Embargo and War of 1812, the face of the nation was still turned toward the sea, interested primarily in the hazardous but profitable carrying trade of those troubled times, and neglecting for the most part internal development. Indeed, Dr. Clark himself admits (p. 235) that "in a very real sense the close of this period (1789–1815), rather than its beginning, marks the foundation of our manufacturing independence." Despite the advent of Slater and the Scholfields and despite other similar signs of coming change, it would seem more accurate and satisfactory to place the real commencement of our industrial activity in the period of the Embargo and War. The preceding period would then be relegated to a subordinate place as a time of preparation, when a sufficient mechanical equipment was being introduced and spread through the country, and when capital was making its first timid experiments with manufacturing enterprise.

Another disputable point arises in connection with Dr. Clark's discussion of the tariff, which on the whole is so sound. It is his conclusion that the development of large-scale production was "one cause (and it seems, an important cause) for the political decline of protection between 1833 and 1860."[2] As he writes (p. 281): "the centralization of manufactures in large plants and within limited areas terminated the intimacy that existed between the early manufacturing movement and the common people. Large

[1] The term "homespun industries" is unfortunately used to cover all household manufactures. See p. 335 below.

[2] This thesis also plays an important part in the article by Dr. Clark on "The Influence of Manufactures upon Political Sentiment in the United States from 1820 to 1860," published in the American Historical Review for October, 1916.

corporations were no more urgent for protection than smaller enterprises. But they represented to the public a new, strange and unwelcome power in the business world, and long before modern trusts were known they were regarded as the embodiment of monopoly, with all its attendant evils." The author's evidence, so far as it has yet been adduced, consists of two or three expressions from southern speakers or memorials, one from Philadelphia (where, as he later points out, peculiar conditions of small-scale production prevailed), and the analogy of the opposition to the Second United States Bank in the early thirties. The last is, of course, the only valid point. The same phenomenon, however, can be found at the time of the repeal of the First Bank's charter; and still we have the mounting protection of 1816–28. Indeed, as regards the only real downward step in the tariff from 1811 to 1846, namely, that of 1833, Dr. Clark admits that " this sentiment (as above expressed) was subordinate to political expedience." Thus it was at least thirty-five years after the first notable emergence of the hatred of monopoly before the force was really effective. By 1846, moreover, large-scale establishments were of considerably long standing. On the other hand, adequate explanation of that change is to be found in the public and Congressional preoccupation with the controversies arising immediately from the Mexican War and with the complex which included those controversies, the momentous slavery question. On the whole, if Dr. Clark's theory be valid (and to prove it, more evidence must be brought forward), it is a negligible factor in the interpretation of tariff changes.

Fourth, certain omissions are noteworthy. The development of marketing facilities and organization is, as I have said above, a matter of importance which should have been included mainly in the work on commerce. It is, however, closely bound with a history of manufactures also, and yet does not in this volume find adequate notice. As is the case with other points in the book, somewhat more treatment is given here than in the *History of Commerce*. For example, the subject of auction sales, a form of distribution which

caused early manufacturers and protectionists much anxiety, receives brief consideration (pp. 241–42 and 358–59). But the development of marketing methods as a whole falls between two stools, finding place neither in commercial or in industrial history. Much remains to be said concerning the development of the " orthodox " distributive organization, when, how, and why it arose, and much concerning its relation to early manufacturing enterprise. Inadequate also, as in the case of the *History of Commerce*, is the qualitative study of home manufacture and foreign importations. Something, to be sure, is here said of the character of the domestic products and occasionally something of the qualities of the goods imported. But the attention given these points is insufficient and the relation between the two is not satisfactorily emphasized. It is especially necessary, for example, in dealing with the competition of both with household production to understand clearly what each had to offer.

Finally, attention may be called to Dr. Clark's discussion of the organization of industry. That he has made it an important part of his history, co-equal with tariff changes and the volume of production, is indeed a step forward from the ordinary treatment. Yet certain exceptions must be taken to his exposition, both as regards the unusual terms employed and the concepts involved. He finds that there have been five distinguishable types of industrial organization in the United States. These he denominates severally homespun, household, workshop-craft, mill, and factory. They did not always follow one another in sequence, for to some extent, " all stages of industrial development were contemporaneous in America " (p. 443). Yet, on the whole, as his discussion shows, there was an evolution from the homespun to the factory form of production.

Some of these types are familiar concepts under new labels. For example, the " homespun " stage, defined (p. 438) as " manufacturing in the family for home use," is recognizable as what we usually call the " household " form. On the whole, moreover, the latter term remains preferable, since Dr. Clark is perforce led to include within his " homespun "

products, not only the various textile fabrics, but also hardware, furniture, shoes, tools and implements (p. 92). Second, the author's " household " stage is easily identified with an old friend: " as soon as such articles (as the above) entered neighborhood exchange," either as " domestic-commercial " or " foreign-commercial," their production was under another industrial form, the " household " industry, which is defined (p. 438) as " manufacturing in the family for outside markets." This, of course, is our old friend, the " domestic system." When Dr. Clark comes to analyze this stage more closely, he finds two different forms of organization, tho both with the technical similarity of complete fabrication within the home — namely, the manufacture for sale through the medium of the country store and the putting-out system, or the working-up of goods for a merchant manufacturer who furnishes the raw material and sells the finished product. This would rule out the term " putting-out system." But why he should have thrown over the phrase " domestic system " in favor of a term which has been heretofore applied to an entirely different form of organization, is inexplicable — especially when the former is wholly adequate and has the added value which comes from established usage. The third form of production, the " workshop-craft," or the " workshop," differs in no way from the familiar " handicraft " system. In fact, the new term is less comprehensive. It does not include the itinerant artisan, who was of considerable prominence in colonial days and disappeared but slowly. He is mentioned by Dr. Clark, yet is ignored in choosing the group name. On the whole, one cannot perceive in these cases a betterment of our accepted nomenclature, while for the many readers who are familiar with the older names and may not carefully identify the various forms in this analysis, some confusion is liable to result.[1]

[1] It should be noted in passing that Dr. Clark's emphasis or preoccupation is with the structural change in industrial form, which he does not always link with the growth of the market. As a consequence, he sometimes implies a growth of technical equipment over and above the needs of the latter. Thus (p. 443) " productive capacity (of the handicraft shop) rose until it exceeded the requirements of work made to order, and even oversupplied local mercantile demand;" and afterwards there " followed an inevitable development of either the technical or the mercantile side of the shop's

Most interest attaches, however, to the insertion of the "mill" stage, or the "mill and furnace" industries. What distinguishes this form from the other types of organization? Is it in reality a separate stage in industrial development? No exact and thoro definition is attempted; but in two places the author gives some explanation. Thus (p. 164) he suggests its relation to the preceding stages: the term "mill and furnace industries," he writes, "may be applied loosely to all forms of manufacture not carried on in the household or at the work-bench." Of these industries, one class, including distilling, cloth-dyeing, and tanning, "depended for perfection upon carefully observed processes rather than upon manual skill or machinery." In another group, "skill was the main element, tho combined with some use of power machinery, as in paper-making and cloth-finishing," while occasionally "power, processes, and skill were combined, as in iron-making." But, if this is the distinction between the "mill" and the preceding forms, what is left to contrast it with the factory? Upon this point Dr. Clark touches most clearly in speaking of the textile industries (p. 447): "It is impossible to define precisely at what point the textile mill became a factory. Yet it is obvious that little spinning-shops of a few hundred spindles did not belong to the same class of industrial organizations as those of Waltham and Lowell. The question is not one of specialization, for sometimes minute establishments were as fully specialized as larger ones; nor is it a question of ownership, for important factories have belonged to individuals; nor of completeness of process, for the humblest undertakers in this field of industry made raw materials into finished cloth; nor altogether of size, for of two equally extensive establishments one might possess the features of a mill and the other of a factory. The definition depended rather upon a combination of equipment and organization." Generally speaking, after the acquisition of power-weaving, the textile mill became a factory. There was no immediate causal relation

operations. It grew into a mill, and ultimately into a larger plant or factory, or else it was embraced by merchant employers as a subordinate unit in a wider system of commercial production."

between these two facts; but usually plants devoted exclusively to spinning were " smaller, more simply equipped, and located in country communities. They followed the analogy of other mills in being owned by individuals or partners and in their relatively less systematic administration of labor." The particulars of the developed form are discussed more definitely in regard to the Boston Manufacturing Company, founded in Waltham in 1812: " Labor was specialized and workers organized by departments. Wages were paid in cash, output standardized, cost accounting introduced, and buying and selling systematized " (p. 450).

With respect to other manufactures, the distinction is not so clearly or fully stated; but on the whole it follows the same line. In the woolen industry, " with the introduction of water-carding, woolen manufactures entered the mill stage," and not until the decade of 1820–30, especially with the adoption of the Waltham system by the Middlesex Company of Lowell at the close of the decade, was the factory stage attained (p. 453). The development, in the second quarter of the century, of manufactures " requiring the mechanical production of uniform and interchangeable parts," such as the watch, sewing machine, and firearms industries, brought these forms of metal-working to the factory system, through " their wide use of power-driven automatic machinery, their systematization of processes, and their administration of labor " (p. 454). Finally, in the iron industry, the factory system was, it appears (p. 456), attained when, soon after 1830, " the technical transformation of this industry with the introduction of puddling and coal-smelting, and its commercial transformation with the growth of railways, made large plants possible and economical."

Such is the character of the " mill " stage, and such the features supposed to distinguish it from the preceding and succeeding forms. We may, then, return to our second question — is it clearly discernible as a separate stage in industrial development? To this we must return a firm negative. The indices by which Dr. Clark would distinguish the mill

from the preceding forms are not decisive. Yet certain inference may be drawn from them. The fact that the work was performed neither " in the household nor at the workbench " and the fact that " power machinery " and " carefully observed processes " were important in mill operations would indicate that the criteria of a " factory " were there satisfied. These criteria may be stated as the labor of persons outside their homes, at hours fixed and under discipline imposed by an entrepreneur. There is agreement manifestly upon the first portion of the definition; and surely an establishment operating power machinery or carrying out definitely formulated processes is improbable, almost unthinkable, without fixed working hours and some measure of discipline. On the other hand, the difference between a " mill " and a " factory," under Dr. Clark's interpretation, is clearly only a difference of degree. Specialization of labor, cash payment of wages, standardization of product, completeness of mechanical equipment are no one of them essential features of the factory. In short, the author's fourth stage falls by the board.

Dr. Clark has called our attention, however, to an important point and has made thereby a contribution to the analysis of American industrial history. The " mill," tho not a separate industrial form, is undoubtedly a subdivision of a true form, that of the factory. Miss Hazard, in her discussion of the boot and shoe industry,[1] found it necessary to separate the " domestic " or " putting-out " system into several substages, altho we have too often thought of it as possessing a single, fixed character. Now Dr. Clark has pointed out that, at least in America, we must make a subdivision of the factory stage. The mill was the early form of factory production. Later — roughly in the twenties and thirties — came the rise of the more mature form, not differing in essentials, but manifesting more of the characteristics of the modern factory system. This maturity is signalized by the changes which Dr. Clark has so clearly analyzed — the attainment of more complete technical equipment, bringing all the main processes

[1] In this Journal for February, 1912.

of a particular manufacture under the sway of power, and in the United States under one roof; the development of large-scale, uniform, systematized production; and the impersonalization of the labor contract indicated by the institution of cash payments and the gradual abolition of the mill store.

To sum up: the *History of Manufactures* is an excellent compilation. It contains practically all the evidence heretofore gathered on the industrial history of the United States up to 1860. Yet it is more than a compilation. Much time and energy have been spent in research. Untapped sources have been disclosed and their contributions interwoven with the earlier material. No doubt, monographs upon individual industries will in time present additional facts. But this volume has brought forward so much in the way of new data that it cannot hereafter be neglected in the study of any important manufacture.

Monographs, however, have a still more important function to fulfil — the assembling and single-minded presentation of the material concerning the particular industry chosen. Dr. Clark writes in his preface that " separate histories of our more important industries " were " recognized as desirable " as accompaniments of this volume. The need for them has not been decreased by this publication. Considering, however, the purpose he had in mind — the exposition of the onward sweep of general manufacturing enterprise — Dr. Clark has given a consistent, orderly, and constructive picture. The attempts made at the interpretation of the known and newly adduced facts, while more successful in some cases than in others, are at various points stimulating and suggestive. The criticisms which I have directed at the several portions of Dr. Clark's discussion are manifestly not concerned for the most part with vital matters. The merits of the book overshadow them. The certainty of the volume's permanent value cannot be doubted.

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NOTES AND MEMORANDA

STANDARDIZATION IN MARKETING

WHATEVER differences of opinion may exist with respect to other functions of government, little is said or to be said against coining money and fixing the standards of weights and measures. Tho these two functions are grouped together in the same clause of our federal constitution, it is doubtful if it is generally realized how close is the logical connection between them. Both result in great economy of effort in the transfer of goods. The economy involved in transferring coined money rather than uncoined metal is apparent. Coining the metal merely enables it to pass from hand to hand without the labor of inspection, that is, without weighing it to determine its quantity and without testing it to determine its quality. It "sells" — if we may speak of selling money — on grade and reputation rather than on inspection. It is the most salable of all commodities, and the fact that it is so standardized as to make inspection unnecessary on the part of the "buyer" has a great deal to do in giving it its superior salability. By the same process of standardization, any other commodity may approach gold coin in salability, tho it may not quite reach it. At least it is safe to say that whenever it can be sold entirely on grade and reputation, and absolutely without inspection, its salability will be enormously increased.

A short step is taken in the direction of standardizing other commodities when the state establishes uniform standards for determining quantity, that is, when it fixes the standard of weights and measures. Without some uniform system even our present methods of selling would be much more

clumsy and wasteful. Every buyer would have to have his own system for determining the quantity of his purchases. This falls short, however, in two important particulars, of what is accomplished when metal is coined in a modern mint. In the first place, the government actually coins the money or requires it to be coined according to its own rules; whereas in other cases it only defines the units of measurement and commands conformity to its definitions. In the second place, coins are standardized, not only as to quantity, but as to quality as well. There is no probability that any government will be called upon to do that which would be analogous to coining money — actually put up other commodities in standardized packages. Something is to be said in favor of fixing standards of quality as well as standards of quantity.

The reasons in favor of fixing standards of quality, wherever it can be done, are identical with those in favor of fixing standards of measuring quantity. They are all summed up in the superior economy of buying on grade and reputation as compared with buying on inspection. The buyer of an unstandardized commodity may have enough confidence in the sellers' system of weights and measures to avoid the necessity of weighing and measuring for himself; but he can scarcely avoid the necessity of inspecting the commodity in order to determine its quality. In some cases, the determination of its quality is easier than that of its quantity, but in other cases it is not. In all cases where quality can be standardized, there is economy of effort. So far as buyers can be saved the trouble of inspection, so far will they be enabled to economize the time and effort involved in making purchases, and so far, also, will the salability of commodities be increased. Whether this will reduce the cost of getting the standardized commodities from producers to consumers, or merely enable the consumers to use their time more advantageously to themselves, may be open to question; but the ultimate economic effects are much the same in either case.

Not the least among the advantages of a minute division of labor is the fact that each individual can avoid the neces-

sity of being expert in many things and therefore has time to become a specialist in one thing. One of the advantages of the standardization of commodities is that the average consumer can avoid the necessity of being an expert judge of the many articles which he has to purchase. He may therefore utilize his time and mental energy in his own special field of work. There is, to be sure, something attractive in the custom of the well-to-do burgher going to market and selecting with the eye of a connoisseur the various articles needed by his household; but it is wasteful of time and mental energy. When he or his housekeeper is able to order by telephone, without any inspection whatever, and still get what he wants, more time is left for other things.

This will help to explain two very distinct tendencies in present day retail marketing methods. The first is to put more and more articles up into standardized packages. The second is to place more and more dependence upon the retailer, who, in many cases, is coming to regard his customers as clients to whom he is bound to give his own expert service. Both tendencies are designed to save the consumer the trouble of becoming an expert buyer. Neither tendency has, as yet, reduced the cost of getting products from producer to consumer. If the consumer utilizes the time saved in earning a larger income with which to purchase goods, it perhaps does him as much good as it would if these tendencies merely reduced the price of commodities.

One reason why these tendencies merely save the time of the consumer rather than reduce the cost of getting the products to him is that the standardization takes place only in the last stage of the process, that is, just before the commodities reach the consumer. In order to reduce materially the spread between the price which the producer gets and that which the consumer pays, standardization must take place early in the process. This will enable the standardized article to go through the channels of trade at a lower cost. If it has to be inspected every time it changes hands, the process is expensive and some one must pay the cost. Some products apparently cannot be standardized, and there must

therefore always be a wide spread between the producers' and the consumers' prices.

A good illustration of the effect of standardizing a product early in the process of getting it from the producer to the consumer is found in the marketing of California oranges. They are graded and standardized as soon as they leave the orchards. All subsequent inspection is therefore unnecessary, and the cost of getting them to the consumer is reduced practically to the physical cost of haulage and handling. This has notably reduced the spread between the two prices. Many other commodities, such as wheat, cotton, pig iron and coal are largely sold on grade rather than on inspection. In these cases, the government has had very little to do with the standardization. Two recent acts of congress, however, have brought the government definitely into this field as the fixer of standards of quality. These are the Cotton Futures Act and the Grain Standards Act. Both give the Secretary of Agriculture power to establish grades and to enforce their use in the regular channels of trade. A number of states also have passed grading laws of various kinds. Four New England states have passed a uniform apple grading law, defining the contents of a standard barrel, describing the various grades of apples, and imposing penalties upon all departures from the standards prescribed.

Such legislative acts cannot be called in any true sense interferences with trade. They are designed to increase the freedom with which commodities may circulate. They are somewhat analogous to the work of the traffic policeman on a crowded corner. He may exercise authority and interfere occasionally with an individual's movements; nevertheless, the result of his so-called interference is greater freedom of traffic.

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EXHAUSTION OF THE SOIL AND THE THEORY OF RENT

ELSEWHERE in this issue Professor Ellsworth Huntington discusses, from a geographer's point of view, the causes of agricultural decay and agrarian discontent in ancient Rome. His well-known contributions to geography and climatology entitle his opinions to most attentive consideration. The topic is of absorbing interest, and its importance for problems of economic history is patent. I would add a few words in regard to its bearing on questions of economic theory.

Of late years, several American writers have laid stress on the exhaustibility of the soil and on the relation of this possibility to the Ricardian theory of rent. Conspicuous among them is Professor Fetter. His view, familiar to economists, is that land differs in no essentials from instruments made by man; that it is not fixed in supply; and that it is subject to waste and deterioration like any other part of the apparatus of production. There is no such thing, according to him, as the "original and indestructible powers of the soil" which Ricardo mentions in the opening paragraphs of his chapter on rent; and for this reason, among others, there is need for radical reconstruction of the entire theory of rent and interest.[1]

I doubt, however, whether this particular ground for wholesale revision is tenable. The solution of the historical riddle does not seem to me of cardinal importance for the theory of rent, either by way of illustration or by way of proof. Neither is the validity of the accepted view of the chemists on the possible or probable depletion of the soil's mineral constituents of decisive theoretical significance. I say the accepted view, for doubtless it is still maintained by most agricultural chemists; tho there are dissidents whose opinions have weight. All this is

[1] Fetter, Economic Principles (1915), pp. 442–45.

of no vital concern for economic theory, whose essential postulates concerning land remain the same whether we accept or reject the principle of exhaustibility.

The fundamental question for the theory of rent is whether there are *permanent causes of difference* between soils. The gist of the Ricardian proposition and of the "orthodox" theory lies in the element of differentiation. As Ricardo himself said, in another passage of the much quoted chapter, "rent is always the difference between the produce obtained by the employment of two equal quantities of capital and labour." So long as there are causes which bring it about that some natural agents respond permanently to man's labor with greater output than other natural agents, the essentials of rent after the Ricardian fashion persist. Let it be admitted that some elements of fertility of the soil can be exhausted, and that these elements of fertility must be restored. Nevertheless, if the process of restoration and of the maintenance of fertility is one which yields larger returns on some lands than on others, we have the differential element. The *response* to man's action varies.

As Marshall and others have pointed out, there are unalterable differences in the annuities of sunshine, of heat and cold, of precipitation, received by different stretches of land.[1] These alone serve to bring about ineradicable differences. The same is true of variations in ease of working. The flat and well-watered prairies of Illinois, just as they will always be more fruitful than the semi-arid lands of the Rocky Mountain region, so will always be easier to till than the hillsides of New England. There are differences of a similar unalterable sort in the physical makeup of different soils — whether they are sandy, gravelly, loamy, rocky. There are differences in the flow of moisture through the soil and in the need of drainage. No doubt it is true, as Marshall remarks, that after long continued cultivation, these differences tend to become less than they were at the outset. The land of an old country comes to have a more homogeneous texture.

[1] See the admirable statement in Marshall's Principles of Economics, book IV, ch. ii, § 3 (p. 147, 6th edition).

But it is never reduced to complete homogeneity; differences persist.

For this reason it is immaterial whether land is or is not regarded as a fixed stock. Marshall sees in the circumstance of fixity an element of essential difference between land and instruments made by man. Professor Fetter seems to me more nearly in the right in maintaining that land is *not* a fixed stock. Land of any one particular kind or for any one particular use certainly cannot be said to be fixed in amount; urban sites, for example. Nor can it be said that the total stock of land in a given country, or even the total stock available for civilized man, is unchangeable in amount. True, the surface of the globe is fixed, and even the surface available for agricultural purposes. In an old country agricultural land is a limited space. Yet the "uses" of land in cultivation are susceptible of increase. So far as the economic supply is concerned, land may fairly be said to be flexible. But, to repeat, the supply, tho flexible, is by no means homogeneous, nor does it tend to become homogeneous. The differential element is not eliminated by man's use of the land.

Reference has been made to Ricardo's much quoted phrase, "the original and indestructible powers of the soil."[1] I suspect that the reason why Ricardo used the phrase and the point which he meant to bring out have been misunderstood. The emphasis should be on "soil," not on "indestructible powers." The phrase occurs in a passage which distinguishes between the rent of land and the rent of mines. As regards mines, Ricardo points out that "the compensation given for the mine or quarry is paid for the value of the coal or stone which can be removed from them, and has no connexion with the original and indestructible powers of the land." The owner of the mine does indeed receive a rent, as he explains in the next chapter (on the Rent of Mines); because some fixed stores of minerals are better than others. But the principles which are applicable to agricultural land, and especially "the laws which regulate the progress of

[1] Principles, ch. ii (p. 35 in McCulloch ed.).

[agricultural] rent and . . . profits," are based on the recurrent and continuous use of the land — that is, on "original and indestructible powers" such as do not exist in mines. "This is a distinction of great importance," says Ricardo, and it is this to which his discussion of indestructible powers is directed. As is indicated in the passage which I have quoted in a preceding paragraph, the essential of his reasoning about rent is that it constitutes a differential return. And the fundamental question regarding rent and interest, land and capital — a most complex question, on which one should speak with much reserve — is whether in fact there is a differential return from land of a kind which is not secured from "capital" in the sense of instruments made by man. As I have elsewhere stated, the answer depends on the effectiveness of competition in bringing about equality of return from concrete capital.[1] Discussion on the exhaustibility of the soil and the fixity of land supply helps us little on this cardinal question.

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SOME CONSIDERATIONS ON LAND TAXATION

Single taxers favor heavy land taxes and tax-free improvements in order to increase building, relieve congestion and lower rents. The argument is that one would not suffer for long a burdensome tax on a vacant lot; he would build and rent in order to recoup. "The owner of a vacant city lot," says Henry George, "would have to pay as much under a single tax for the privilege of keeping other people off of it until he wanted to use it, as his neighbor who has a fine house upon his lot. It would cost as much to keep a row of tumble-down shanties upon valuable land as tho it were covered with a grand hotel or a pile of great warehouses filled with costly

[1] See my Principles of Economics, ch. 46, § 3.

goods." Mr. George was not aware of the fact that the same would be true were lots tax-free. It costs as much to hold a tax-free lot as a tax-burdened lot. Why? Lots are valued according to their anticipated yield. Taxes are allowed for in the capitalization of land and are, therefore, no burden to the purchaser of land. A tax is a subtraction from yield, therefore a tax increase means a value decrease. A low value means a small interest burden. An increased tax burden is but a substitute for a high interest outlay. The cost burden on your real capital is the same whether land be subject to a single tax or tax-free. Your dollar will buy as many land uses under the one as under the other. If this is not so the accepted theory of capitalization on the basis of net earnings is a delusion. If you encourage building by freeing improvements from the tax you equally discourage the improvement of a lot by extracting its value in the form of a tax. The one equalizes the other. If you tax me $100 I am little concerned whether you assess it against my house or against my lot. The single tax would little influence the amount of building, rent burdens and congestion.

The opponent of the single tax argues that under a single tax régime the tenant's rent must pay the interest on the value of a lot, the single tax, and interest on the cost of a building, otherwise no one would build and rent him a house. Thus they believe that the single tax would be shifted to the tenant in the form of a higher rent. This would result in congestion, in getting the most out of a limited space, in building high into the tax-free air. The single tax would be as a fixed charge on tenantry and its burden could be lightened only by distributing it widely, therefore low rents could be found only among a numerous tenantry on a limited space.

This, in my judgement, is a criticism without foundation. In this is met the same principle above mentioned. The single taxers and their opponents are but exhibiting the backward and the forward looking faces of the same thing. Higher land tax, lower capitalization and less interest outlay go hand in hand. The air is as interest free as it is tax free; there is no more reason for building high to dodge the tax than to dodge

the interest charge. The logical conclusion for these thinkers (so far as I know they have shied from it) is that a tax on land is shifted. In the above I have given their thought a rather bold wording; the use of the word *shift* would save them from much circumlocution. If the single tax would discourage building on idle land then a limited area would be more intensively used — less land would have to do the land work. The greater the intensive utilization the greater would be the cost and the higher the price of land products. High taxes would be shifted to high prices. Idle resources, misdirected energy, scarcity of product and high prices would, according to their thought, be the unprofitable reward of a single tax régime. The futility of this word logic is that returns relative to costs would not be modified by a single tax, the thing changed is the form of the cost and not its amount. The motivating force of investment is profits and profits would remain the same.

Another set of kindred arguments is that of the diffusion of the unearned increment. These arguments form another unworkable tax-shifting scheme. The idea runs that the lure of the unearned increment is the cause of early frontier settlements. Reversely a single tax would discourage frontier settlements by absorbing the unearned increment. Under a single tax régime, asks Professor A. S. Johnson, "when would our Western forests have been cleared, our prairies transformed into fields of wheat and corn? Not in decades, but in centuries." Further, "under such a condition of development Kentucky would doubtless still be a dark and bloody ground, and the Ohio forests a haunt of outlaws." [1] The thought is that, in anticipation of the unearned increment, frontiersmen, for the time being, will tie up capital unproductively and work for a lower return than the normal wage. The development of new lands, the sacrificing of labor and capital upon them cause greater abundance of agricultural products and therefore lower prices.[2]

[1] "The Case Against the Single Tax," Atlantic Monthly, January, 1914, p. 33.

[2] Johnson, ibid., p. 34, and T. S. Adams, American Economic Review, June, 1916, p. 271.

The assumption underlying this argument is that frontiersmen have poor judgment, that they suffer privation from an over estimate of the increase of land values. It follows from their assumption that national development, lower prices and community gain are results of misdirected energy. The greater the error in judgment the greater would be the national gain. If this argument is not based on the misjudgment of frontiersmen then it is self-contradictory, for if more than the unearned increment is shifted to national gain (and it must be more than shifted if wages are below normal and capital is employed at a sacrifice) then no unearned increment could be left for the frontiersmen.

These arguments, moreover, rest on false economic grounds. The extra cost of marketing for one beyond the border of remunerative industry will more than offset the extra costs of production nearer the market. The result of this is a larger total cost of production, and waste energy together with increased prices as a consequence of the reduction in supply. Production is not complete until the products are in the hands of the consumer. Production in the wilderness is not cheapest. If it were, competition would force all producers to the wilderness. It is a false economy which assumes that misdirected energy is a national boon, that production at the greatest cost means the lowest price, that the unearned increment is secured to the public by a scheme that would increase the cost of living. Two difficulties are in the way of such arguments; a false conception of the extent of the so-called unearned increment and the belief that a tax on land cannot be shifted, or at any rate a false conception of the manner in which the shift takes place. If it were seen that an unearned increment is as common to other agencies as to land the single tax bugaboo would have no logical basis. If it were seen how a tax on land is shifted we would have the true manner in which the unearned increment inures to society in the form of more products and cheaper prices.

Space forbids more than the briefest sketch on these points. Large and dramatic changes in values bring benefits both to sleeping partners and to active enterprisers in all lines of

industry. The passive owners of land, war stock, lottery tickets, furs, copper, huckleberries, and saw mills may reap large gains from lucky turns in prices. Prices are made in the market and are largely beyond the control of any individual. The active enterpriser with the deep insight that gives foresight can best judge of price changes and movements in capitalization. He can so shape his enterprise as to reap the surpluses which always accompany industrial changes. The unearned increment is a question-begging phrase applied especially to the profit of the land owner. There is nothing peculiar to land profit. The teachings of Walker, Cannan, Hobson, and Clark on the extension of the rent problem and the general applicability made by these and later writers of the law of diminishing returns, cannot but teach that a common principle regulates the returns of all productive agents. The trouble with most economists on this point is that they get their geography and their economics mixed. They think of the supply of other productive agencies in terms of productive capacity and not in terms of bulk or weight, but when it comes to the supply of land they shift from a productive or economic basis to an area or geographic basis. It is but a truism that a superior organization which enables a laborer to turn out ten pieces a day instead of five pieces, really doubles the economic supply of labor; or that a new process or scientific method that enables a unit of land to yield ten bushels instead of five bushels does add to the productivity of land. The supply of productive agents is measured in yield, not in area or bulk. We must measure land as a productive agent in terms of its productive capacity. It is as logical that we do this as that we ask different prices for different qualities of land. Land capacity is what concerns the economist and whatever increases this capacity increases the land supply.

Instances of unearned increments might be multiplied indefinitely from all walks of life. The growth of complex social problems makes the lawyer's fifty thousand dollar fee a possibility; acquisitive advantages and monopoly gain are unthinkable apart from society; political security, educational,

religious, and other social institutions are unearned benefits to the individual. National productive capacity in the form of natural resources together with our inherited knowledge of ways and means of how to harness, transport, and bend the utilities of man and nature to our service, form a fund of unearned social heritage. We can soon rebuild the ships, houses and current supplies destroyed by the war. If the war could destroy our knowledge of ways and means or the natural forces upon which they operate, civilization would be set back indefinitely.

The supply of land like that of other productive agents is measured by its yield. Other agents come from the land, therefore, to say that land is limited is to say that other agents are limited — all are limited by the natural principle of resistance. All are limited by and obey in their operation the law of diminishing returns. If the land supply is subject to change then there can be nothing peculiar in the unearned increment of land.

Let us turn to the manner in which a tax on land can be shifted. A tax on marginal land would throw it out of cultivation and thereby cause less land or fewer land uses to be cultivated. The result would be a greater scarcity and therefore a higher price for the products of land. In other words the tax would simply bring about a higher price for the products of land. A tax on the surplus or rent can be shifted. To the extent that you tax land you reduce its net returns to the landlord, but the landlord values his land according to its net returns, therefore to the landlord the land loses in value to the extent of the tax. The principle of proportionality teaches that less expenditure in the form of upkeep and repairs is made on the less valuable agencies. High tax means low land value, the discouragement of upkeep and improvements with the consequent falling off in the supply of land products. Thus a diminished supply means a shift in tax in the form of higher prices of land products. Prior to our Civil War we practised land butchery and that too with sound economic justification. The cheapness of land, the little cost of wearing out old land and shifting to new invited

butchery. Labor and capital were scarce and their great value invited their most economical utilization. High tax, little net yield, low value, depreciation, low gross yield and high prices of land products go together.

The thrift which accompanies private property claims attention at this point. To the extent that a tax subtracts from net gain it puts the landlord in the position of a tenant. If a nine year's lease ruins the garden a heavy tax would tend to the same end. If the magic of property turns sand to gold the lower the tax the greater the tendency to that end.

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